THE METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD, COPPER AND BRASS, THE BRASS FOUNDER AND FINISHER AND
ELECTRO-PLATERS REVIEW

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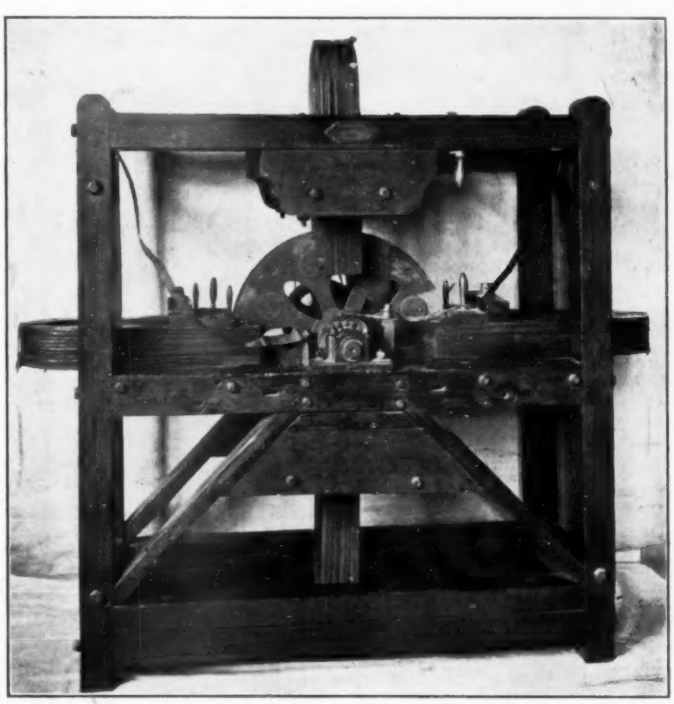
EARLY ELECTRO-PLATING MACHINES

By W. H. Carbutt.

An Historical Sketch Concerning the First Dynamo for Electro-Plating, Now on Exhibition at Aston Hall, Birmingham, England.

There stands in Aston Hall, Birmingham, England, a machine which is stated to be the first electro-magnetic machine used for electro-plating. The claim is practically undisputed, but requires some qualification. Probably the machine was the first that proved anything like a commercial success. But investigation shows that it does not represent quite the first form of the attempt to utilize Faraday's great discovery of induction to provide a current for plating purposes. It is dated February 22, 1844, but its inventor, John Stephen Woolrich, a Birmingham chemist, took out in 1842 a patent for "Improvements in coating with metal the surface of the articles formed of metal or of metallic alloys," the specification of which sets forth that "My improvements . . . consists (sic) in the employment of a magnetic aparatus in conjunction with metallic solutions," and the description of the machine precedes the account of the electro-chemical process.

The specification and the accompanying drawings are of a uni-polar machine, the inventor of which, like other experimenters of his day, relied upon a permanent magnet for his field. The drawing shows one compound magnet of eleven laminae. The magnet was to be placed "in a horizontal position on a wooden platform or table." This may have been thought most convenient for mechanical reasons. Whether Woolrich had any other reason in his mind, it is impossible to say. The armature was to be made of soft iron and fixed to a spindle or shaft, so as to revolve before the poles of the magnet. It was, in fact, a lateral-pole machine. The drawings show the shaft resting on bearings between the arms of the magnet, so that the armature, in a circular plane at right angles to that of the magnet's length, revolved like a toy windmill. The coils, of which there were but two, are shown with their solid iron cores end-on to the magnet, and each, according to the specification, consisted of about 50 feet of copper wire, 1/10 inch thick, covered with silk thread and wound in a spiral direction, round each end (or core) of the armature. Lateral poles, by the way, were used in the Brush arc-lighting machines of twenty years ago and in the early Siemens alternators. That Woolrich had at least experimented with such a machine appears likely from the directions he gives with regard to varying the air-gap—though he does not use the term. In the concluding portion of the specification he states that "The distance of the magnet from the armature is determined by the superficies of the article to be coated, the distance being inversely as the superficies." He adds, "If the surface of the article to be coated with metal becomes, while in connection with the magnetic apparatus, of a brownish or darkish appearance, or if gases be evolved from the surface of the article, the magnet must be adjusted." For this purpose a large wooden adjusting screw is provided.



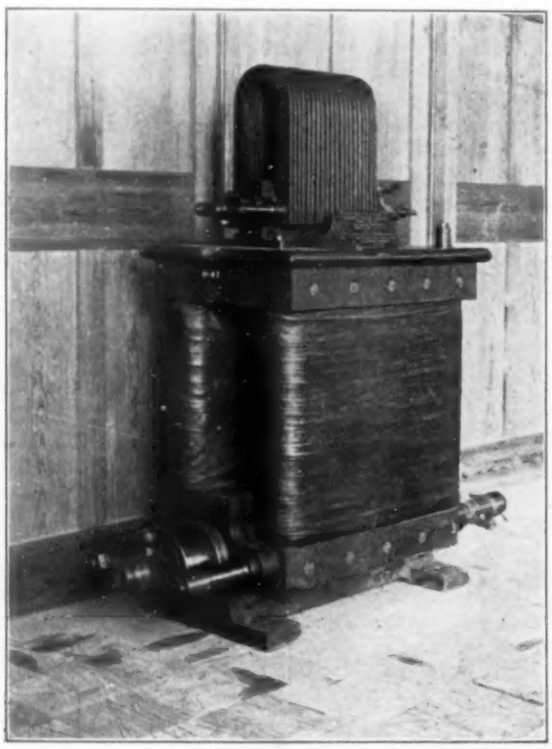
THE FIRST ELECTRO-PLATING MACHINE NOW IN ASTON HALL, BIRMINGHAM, ENGLAND.

A considerable advance in construction, power and method of operation over the uni-polar machine of Woolrich's first specification is represented by the machine of 1844, shown at Aston Hall, which is quadri-polar. No detailed description of it by its inventor or its makers appears to be extant. The patent office records make no further mention of a grant to Woolrich for an electro-magnetic machine. Possibly he found that, with many others in England and on the Continent working contemporaneously on the subject, it was impossible to establish the necessary claim to originality. In his specification for a further patent for electro-plating in 1849, he simply states that the current may be obtained from a machine, a battery, or in any other way.

The 1844 machine, which was presented to the corporation by Thomas Prime & Son in 1889, has been for

some years at Aston Hall—the "Bracebridge Hall" of Washington Irving, though the "Sketch Book" places it in Yorkshire—once a lordly country mansion, which, as the inscription over the entrance records, was built by Sir Thomas Holte, a member of an ancient family and a great Midland landowner. Sir Thomas began the erection of the hall in 1618, and completed it in 1635. Famous, with his family, for loyalty to the Stuarts, he entertained Charles I. in 1642. In the great gallery—the finest of such apartments in the country after Hardwick and Hatfield—stands a beautiful and curious inlaid walnut cabinet, left by the unfortunate king as a parting gift. The richly carved oak staircase still shows the damage done by the Parliamentarians' cannon, when in 1643 the hall was beseiged and the loyal old baronet had to surrender after the loss of twelve of his comrades.

To dwell upon the associations and the beauties of this wonderful preserved example of the homes of England is not relevant to the purpose of this article. The

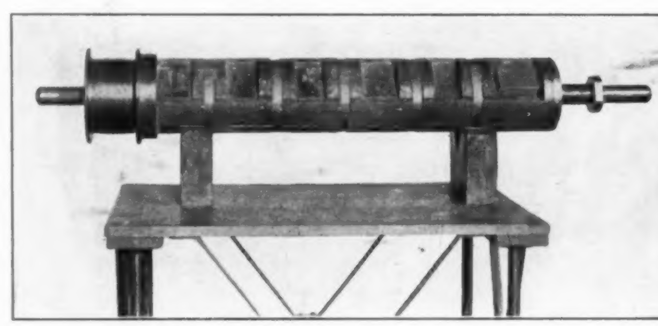


ORIGINAL WILD DYNAMO, PRESENTED TO BIRMINGHAM UNIVERSITY BY ELKINGTON & COMPANY, LTD.

Holte family is extinct. The last of the name died in 1782, and the Hall, after being occupied by Heneage Legge, a connection by marriage through the Bracebridges, to whom the Holte estates reverted, was sold under an Act of Parliament, a Warwick banking firm being the purchasers. One of the tenants of the Hall under them was James Watt, son of the famous engineer. In 1878 the building and a portion of the park were sold to a public company for £35,000 and Queen Victoria, with the Prince Consort, opened it as a place of recreation for the people. The vicissitudes of the Hall ended in 1864, when the Corporation of Birmingtam—though the building was not then, as now, within the borough boundary—took it over with 43 acres of the park, which was once three miles in circuit, the rest of the Holte estate of 1,530 acres having gone into building lots. Since then Aston Hall has been a public museum.

In the room which once formed the family chapel is to be found, with many other incongruous objects, what is often spoken of as the first plating dynamo. The designation is, of course, inaccurate. The term dynamo—electrical machine, shortened into dynamo in 1882 at the instance of Sylvanus P. Thompson—was given by Dr. Werner Siemens in 1867 to his invention expressly to distinguish it from the permanent magnet machine. The machine now at Aston Hall was designed by Woolrich and constructed and used by Thomas Prime & Son, a Birmingham firm of electro-platers. It may rightly be regarded, in the absence of any surviving rival, as the first magnetic machine ever used on a commercial scale for the deposition for silver, gold or copper. As such, it was loaned by the corporation to the World's Columbian Exposition, at Chicago, in 1892, and upon the wall near its present resting place are displayed the blue ribbon and the official diploma attesting the recognition of its claim. From this it appears that the machine was in use by Messrs. Prime until 1877. That the firm prided itself upon the possession of this and other similar machines is evident from the fact that they named their factory "The Magneto Works." Faraday, during the meeting of the British Association in Birmingham in 1849, visited Messrs. Prime's works on purpose to see this heir of his discovery. He is said to have expressed intense delight at witnessing his discovery so early applied and so extensively carried into practical use.

The framework of the machine is formed of 3½-inch mahogany squared timbers, bolted together and strengthened in the lower sections by struts and key-blocks. Its



SPARE ARMATURE FOR THE WILD DYNAMO SHOWING METHOD OF WRAPPING WITH COPPER STRIPS ABOUT 3 TO 4 INCHES WIDE.

height is about 5 feet 4 inches, its length nearly 6 feet, and its breadth about 2 feet. The machine has four permanent magnets arranged radially around the armature, two horizontal and two vertical. These are permanent steel magnets and still retain much of their magnetism. They are almost exactly similar to the magnet of Woolrich's first machine, being of elongated horseshoe form and made up of 11 laminae of 3-inch by ⅜-inch section. Each magnet measures over all 26½ inches in length and 8½ inches in extreme width. A bolted wooden block holds each to its bearer in the frame. This may have been designed for adjustment, but Woolrich or the constructors had devised a readier means of varying the voltage. Across the arms of each magnet, not far from the poles, are seen three flat bars of soft iron, one large and one small, with small projecting handles. The field could be varied and the strength of the current roughly controlled by sliding on or off each magnet one or more of these bars—the residual magnetism being such that, even now, those which are not rusty cannot be removed by a direct pull.

The armature, which extends three or four inches between the magnet poles is made up of two brass discs 25 inches in diameter, with large lozenge-shaped perfor-

ations, supporting between them, near the periphery, eight solid soft-iron cores—which in this case are parallel with the pole-faces of the magnet. The cores are four or five inches long and probably about 1½ to 2 inches in diameter and are wound with insulated copper wire (apparently about 14 B. W. G.) to a diameter of about 4 inches. The spindle of the armature rests in bearings bolted to the horizontal timbers and consisting of brass split bushes. At the back—as the machine now stands—there is a pair of flanged fast-and-loose pulleys about twelve inches in diameter to carry a 1-inch to 1½-inch belt.

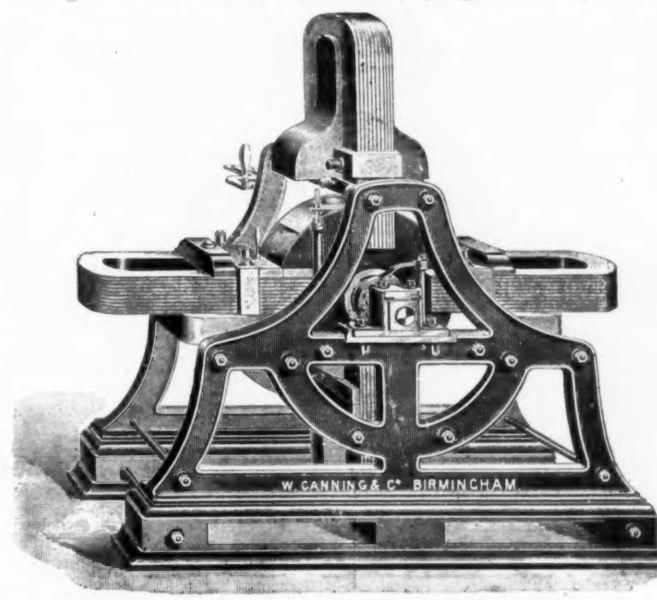
On the front end of the armature spindle is a brass commutator about 8 inches in diameter, and 1 inch deep, in eight segments, with an upper and a lower brush.

ASTON HALL, BIRMINGHAM, ENGLAND.

The lower brush is missing but each evidently was formed by a short strip of brass about 1 inch wide, and ⅛ inch thick. The brushes are bolted to a roughly forged rocker arm, consisting of angle pieces of iron standing out from the wooden frame. No means of rocking the brush appears to have been provided, but the bolt-hole is slot-shaped, evidently to provide for some initial or occasional adjustment. In contact with the brush are two long strips of copper 1¼ inches by 1/64 inch, evidently portions of the original leads. On the farther side of the armature the spindle carries a solid disc of copper or bronze about 1⅛ inches thick and 7 inches in diameter. It has underneath it the remains of a brush, and may have been used as a collector-ring for an alternating current or to form various combinations with the commutator. An engraving shows copper strips leading from this side of the machine, but these are now missing. That the Woolrich machine in this form must have been more or less a success may be gathered from the fact that at least one other of almost exactly the same construction was made. The fellow to the Aston Hall machine is now owned and kept as a curiosity by W. Canning & Company, of Great Hampton street, Birmingham, makers of plating and polishing machinery and materials. They bought it in 1889 when Prime's factory, in Northwood street, was closed, and the plant was sold by auction.

This machine, the second made by Messrs. Prime, to Woolrich's specification, is dated May 20, 1851. In general appearance it is a great improvement upon its predecessor. It has a cast-iron frame in two pieces, about 4 feet high, the front and back sections being bolted together. The machine, to the top of the upper magnet, is almost 5 feet high, and the total weight is nearly a ton. Like its immediate predecessor, it is a four-pole machine, each of the permanent magnets being 36 inches long and 9½ inches wide and formed of 10 laminae of 2½ inches by ⅜ inch hardened steel. The discs between which are mounted the eight armature coils differ from those of the 1844 machine in not being ventilated on the sides. The spindle is of steel, and in mechanical arrangement the machine is nearly up to the present-day standard. The driving pulley has no loose wheel. The brush, the mounting of which is much neater than that of the Aston machine, is a strip of 1 inch by ¼ inch brass. There is a brass disc on the other end of the spindle, but nothing remains to indicate its purpose. Both machines are thought to have been capable of maintaining a pressure of two volts. Owing to the absence of adequate provision against overheating, neither of these two machines could have ever been worked to anything like the full output of which it would otherwise have been capable. Canning's "Midget" dynamo (1894) 8 inches by 5 inches high with ten times the power, makes a striking contrast with the electro-magnetic machine of sixty or seventy years ago.

It is natural to inquire what part, if any, the firm of Elkington played at this time in the application of the magneto-electric machine to electro-plating. George Richards Elkington, when the first Woolrich machine was brought out, had been for some years working upon the subject of coating metal by means of solutions and had, with the aid of Dr. Wright, a Birmingham surgeon, solved the problem of electro-deposition. For this a patent was taken out in 1840, and, Elkingtons having established their rights as the originators of the process, all electro-plating for some years afterwards was done under license from them. In 1844 Walker, of Sheffield (now Walker & Hall), took out a license from Elkingtons, and Prime was also paying them royalties.



THE SECOND ELECTRO-PLATING DYNAMO MANUFACTURED IN 1851, NOW IN POSSESSION OF CANNING & COMPANY, BIRMINGHAM, ENGLAND.

Yet in 1850, at the meeting of the British Association, Mr. Elkington stated that he had never been induced to give up the primary battery in favor of magnetism.

It was, however, recorded in an account of the trade forming part of the handbook prepared for the visit of the British Association in 1865 that a machine had been used by Elkingtons as well as by Prime, Fearn and other electro-platers in Birmingham. One of the oldest workmen now at Elkingtons confirms this. The machine stood 7 or 8 feet high and appears to have been an eight-pole magneto-electric machine of the permanent magnet type, though the magnets had to be taken out at intervals and

re-magnetized. They were not in any sense electro-magnets. As far as can be gathered they were a modification of the Woolaston-Bailey type, and were of soft iron charged by contact with a large permanent magnet. The machine is said to have been capable of depositing 10 to 12 ounces of silver per hour, which would mean a current of about 85 amperes. The Aston Hall machine is believed to have deposited three or four ounces per hour, representing a utilizable current of about 27 amperes. In the handbook already referred to, the machine used by Elkingtons is described as "precisely similar to that of Mr. Holmes, which was shown in the machinery department of the exhibition employed for producing the electric light." The Mr. Holmes referred to was the founder of the firm of Holmes & Co., electrical engineers, Newcastle-on-Tyne.

At all events, the present chairman of Elkington & Co., Ltd., Mr. Herbert Elkington, a grandson of George Richards Elkington, declares that up to this date the firm did practically all its plating by means of primary batteries.

The definite adoption by Elkingtons of machine-produced current dates from 1866, when Wilde produced his magneto-electric machine, regarded by this firm as the first practical dynamo. "It consists," to quote the description of the late Dr. George Gore, of Birmingham, "of two electro-magnets, a small and a large one, with insulated copper wire coiled transversely upon them, and with armatures of soft iron (also with insulated copper wire lengthwise upon them) revolving between their poles. The residual magnetism of the small (or upper) electro-magnet excites a feeble current in the coil of its revolving armature. This current circulates through the wires of both the magnets and increases the magnetism; and the increased magnetism of the small one re-acts upon the armature and increases the current, and so on, until both the magnets are saturated with magnetism at the expense of the mechanical power. The current from the revolving armature of the large one alone is used for electro-deposition or other purposes. The armatures of both machines are driven at a speed of about 2,000 revolutions per minute, and at this rate the current from the large one deposits 28 ounces of silver per hour, with an expenditure of two horsepower." This represents about 215 amperes. But the first Wilde machine was of lower capacity than this. Gore was wrong in saying that the armature winding was of wire. It was of copper strips, about 3 inches wide, wound longitudinally.

The first machine made by Wilde was purchased by Elkingtons in 1866, and was a short time ago presented by them to the Birmingham University as a relic. Wilde machines, up to and beyond the end of the last century, were in extensive use by Elkingtons, both in Birmingham, for the depositing copper statues and for general plating with silver, and also at the works at Pembrey, near Swansea, for electrolytic copper refining. A single multiple-armature of Wilde's, according to an article in the Philosophical Magazine for June, 1913, would deposit 4½ cwt. of copper in twenty-four hours. This, if correct, would represent a current of 8114.4 amperes. The bases of the large electro-magnets were originally made hollow, and a fan was provided to drive air through them to keep the armature cool. Elkingtons, however, found that with this method of cooling the machine could not be run continuously for above an hour. The cavities, therefore, were filled up with lead and water was pumped through the armature, a method which was continued as long as the Wilde machines remained in use. It was also soon found that the smaller, or exciting dynamo, which was driven by a separate belt, could be dispensed with—that, in fact, the main dynamo was self-exciting.

A patent for a self-excited magneto-electrical machine for plating was taken out early in the eighties by a Birmingham electro-plater named Hemming. His was a two-pole machine with a two-part armature, the core being laminated and of H cross-section. The cores were wound with wire and covered with wood, and were connected to a two-section commutator. The machine, which was shunt-wound, was considered, for its purpose, to be a distinct improvement upon the other machines known then to platers, as the full necessary efficiency could be obtained by running it at a reasonable speed. Being of moderate size and capable of being manufactured at a moderate cost, it gave a great impetus to the electro-plating industry. It was taken up by Cannings, and formed the starting point of the electrical engineering department of their business, a great many firms being largely financed by them in order to promote its use. The machine is no longer made, but hundreds are still running in Birmingham.

With the successful substitution self-excited electro-magnets for the permanent magnet by Wilde, Siemens and others, the first chapter in the history of the magneto-electrical machine may close, though the permanent magnet machine continued in use for some years in electro-plating and even later in some lighthouse installations.

The plater of the present day has at his service machines far less cumbrous and of enormously greater efficiency than those represented by the venerable relic at Aston Hall. But here, as elsewhere, progress moves more or less in a circle, or, it may more aptly be said, in a spiral. The growth of the electro-plating industry, fostered by the successive improvements in the dynamo, has stimulated research into the phenomena of electrolysis. Thus it has come round that to the plater, who began with the primary battery, has been given, as an adjunct to the dynamo, the secondary battery, which has already been put to good use in the industry and is probably destined to play a still more important part in its future.

For assistance in preparing this article the author's acknowledgments are due to Mr. H. M. Ryder, of Elkington & Company, Limited; to Messrs. Canning & Company and Mr. Pope, manager of their dynamo works, and to Mr. Cedric F. White.

DUTY ON ZINC DROSS.

Assistant Secretary of the Treasury Hamlin has ruled that the tariff duty on zinc dross and zinc skimmings should be 10 per cent. as metal unwrought. This ruling was communicated to the Collector at New York in a letter reading as follows:

"The department duly received your letters in which you state that zinc dross and zinc skimmings would be assessed with duty at your port at the rate of 15 per cent. ad valorem, under paragraph 163 of the Tariff Act as old zinc fit only for remanufacture.

"The department is of the opinion, on consideration of the question, that such merchandise does not come under the provision of the said paragraph 163 for old and worn out zinc fit only to be remanufactured, but is properly dutiable at the rate of 10 per cent. ad valorem, under the provision for metals unwrought in paragraph 154 of the existing Tariff Act, or, in the alternative, at the same rate as waste not specially provided for, under paragraph 384 of the said act.

"You will, therefore, assess duty on zinc dross and zinc skimmings as metal unwrought, at the rate of 10 per cent. ad valorem, under paragraph 154 of the Tariff Act of October 3, 1913."

THE HERING ELECTRIC FURNACE FOR COMMERCIAL BRASS MELTING*

Some Later Developments in the Economical Melting of Metals.

By G. H. Clamer.†

The development of this furnace has been progressing very favorably. Being a departure in an entirely new direction or type where no precedents existed, much of the necessary information existed, much of the necessary information concerning data for the best proportions and design had to be obtained by actual trial on furnaces themselves, as it did not exist in books and tables; among this data were a number of physical constants which are beyond the ranges given in tables. Moreover the data had to be obtained on a practical scale as distinguished from a laboratory scale. Development work of this kind requires running a furnace to destruction in order to find out its weak points; quite a large number of experimental furnaces were used up in this way.

Furthermore, certain modifications in the proportions, design and construction gave such promising results that it was thought best to hold back the completion of the several larger commercial furnaces now under construction and nearly completed, until these modifications had been thoroughly tried out on experimental furnaces. This has now been done and the improvements have given such good results that the delays in the completion of the several larger commercial furnaces were warranted. Several of the commercial brass furnaces are now nearly ready to be started.

The general description of the furnace has been given in other published papers.‡ Briefly, the furnace is of the resistance type (that is, not an arc furnace); the metal is heated, like the filament in an incandescent lamp, by passing the current through what might be termed a thick filament, or column, of the liquid metal. The furnace itself consists of a hearth, having two, three or four cylindrical holes in the bottom, which are closed at their far ends by the electrodes. These holes may be vertical, horizontal or preferably inclined upwards into the hearth, and, of course, are filled with the molten metal of the hearth.

By means of the electrodes, the electric current is then made to pass through the columns of metal in these holes, thereby heating very rapidly. The proportions are made such that all the heat of the furnace is generated in the metal in these holes. In addition to thus heating the metal, the current also exerts a peculiar force by means of which it circulates the metal very rapidly in these holes by forcing it out into the bath and sucking fresh liquid metal into the holes; hence the heat of the furnace, which is originally set free in the holes, is rapidly transmitted to the bath of metal in the hearth, and in addition a most thorough mixing and stirring occurs. It is this circulating force, popularly known as the "pinch effect," which is the basis of the furnace and which makes such a method of heating possible.

Cold metal is melted by immersion in this heated bath. The hearth can be kept closed, thereby avoiding any loss of zinc vapors. It is opened only while cold metal is being inserted. Moreover the space in the hearth above the metal can be kept neutral or even reducing, whereby all oxidation is prevented. The furnace can be made tilting if desired, as the transformers for the electric current are attached permanently to the outside. As the walls may be made thick, the furnace gets only slightly warm on the outside, even after continuous running night and day. The furnace itself is ideally simple in construction and the only perishable part, the hearth and heating holes, are easily renewed when worn out. Brass, bronze, copper, lead, iron, steel, ferro-silicon, etc., have been melted in it repeatedly. It has repeatedly been run day and night continuously without any undue overheating in any parts.

The developing has been done with small furnaces of about 25 to 30 kilowatt, and has been greatly retarded by the transformers not giving their rated capacities, for which, of course, the furnaces were not responsible. Being only small furnaces, the losses of heat per pound of metal was necessarily greater than they would be in a large, well-built, commercial one. Moreover much heat was lost through the top, which was only crudely closed. No particular efforts were made in these tests to economize the heat, as it will readily be seen that this can be done very effectively in a large, properly built furnace, and involves no difficulties, depending merely upon how thick one is willing to make the walls and cover. The recent development had to do chiefly with finding the best form and proportions of the water cooled electrodes and the best dimensions of the heating holes, on which latter the effectiveness of the circulation through them so greatly depends; the greater this circulation the smaller the furnace for a given duty. Notwithstanding that no particular efforts were made to economize the heat losses, the results were very favorable, considering the small size of the furnace and the fact that the transformer could not supply more than about half of its rated output for which the furnace was built.

Ordinary yellow brass was melted repeatedly, including superheating, at a rate of about 8.7 lbs. per kilowatt hour. Considering the abnormal losses in the transformer and the fact that no special efforts were made to economize the heat losses, the furnace being frequently opened at the top, these results are considered quite favorable. With conservative estimates, it is thought that this figure might be increased to 10 lbs. and probably more. The figure for theoretically perfect operation is not known definitely, but is believed to be about 14 lbs.

At one cent per kilowatt hour, this would therefore mean about 10 cents per 100 pounds. But, as was explained in a former paper, it is not proper to compare this figure directly with the fuel cost for melting brass in the usual combustion furnace, as there are other factors of equal or even greater importance which should also be included. Among these is the reduction in the loss of zinc, which loss in the fuel furnaces sometimes involves an even greater cost than the fuel cost. Concerning the loss of zinc in the furnace, the best indications that there is practically none is that there is an almost entire absence of any white fumes coming out of the furnace. The only loss of zinc by white fumes was from the thread of metal as it was being poured out, and this, of course, cannot be avoided in any furnace. There is, furthermore, no loss of metal by spattering; all the metal that is put into the hearth must come out, without loss, as melted metal. There is no loss by oxidation, as the atmosphere in the furnace may always be made reducing with a little charcoal. The losses by combustion with sulphur in the fuel gases are, of course, also entirely absent. The saving of the losses of metal therefore are of great importance, and in some cases might alone pay for the cost of the electric power.

*Paper read at Chicago convention of American Institute of Metals, October, 1913.

†Vice-President, Ajax Metal Company, Philadelphia, Pa.

‡The Metal Industry, May, 1911.

There being no crucible, the cost of the crucibles is saved. Against this item should be charged the cost of relining the furnace, which in the present form is simple and cheap, and could readily be done over a Sunday. The wear on the lining in a brass furnace has been found to be so slight that this cost of relining, per 100 pounds of metal, will undoubtedly be almost insignificantly small. As to what the saving in labor cost will be has not yet been determined, but there is not any question that the labor cost will be considerably reduced, as will also the foundry floor space per ton per day, as these furnaces may to advantage be forced, hence may be made to give a relatively greater output per day. It might be added here that it has been shown that there is no difficulty whatsoever in getting the required high temperature, for by simply leaving the metal in the furnace a little longer the temperature will rise to any amount desired.

The fact that the liquid metal is continuously circulated upward, like the boiling water in a kettle, brings all mechanical impurities, gas bubbles, etc., including no doubt also the sulphides and oxides, to the top, leaving the metal pure. With a blanket of charcoal over the top, some of the oxides might even be reduced. The furnace may, of course, be made tilting, as all those under construction now are, and they may, if desired, be made to tilt around the lip, thereby facilitating the pouring directly into ingots or molds.

It might be of interest to add here that copper has been easily melted repeatedly in these furnaces. This was one of the unexpectedly favorable developments, because copper has such a low electrical resistance that resistance furnaces for copper have heretofore been impracticable. In the present furnace the proportions of the heating holes for copper do not become impracticable, though it was feared at first that they might be.

One of the chief and most difficult parts of the furnace to develop was the water-cooled electrodes connecting the transformer with the melted metal in the bath. A very successful form of construction of these parts has now been devised and tested out, and has given entire satisfaction. It has also been found that the circulating force may be made much greater than was at first supposed, and this makes the design and proportions of the heating tubes more favorable, and reduces the size of that portion of the furnace. This circulating force was in one test so great that the liquid metal rose about an inch above the surface where it was squirted upwards; the velocity was so great that at times drops of metal were thrown off at the surface by this rapid evolution, though not enough to spatter the metal. If a suitable pyrometer exists to be placed into the heated metal, it is possible to regulate the temperature with great precision, thereby avoiding both under and overheating.

In a small 10 kilowatt furnace, what is known electrically as the power factor, was accurately measured and was found to average about 95 per cent., which is greater than was expected and is practically perfect. In a larger furnace a crude measurement gave about 85 per cent., but it is believed that the instruments may have been somewhat in error and that it was probably higher.

It is to be regretted that the delays of the development of this furnace have made it impossible to give further data concerning larger commercial furnaces at present in this paper, but as one of the peculiarities of this type of furnace is that the principle is more difficult to apply to small than to large furnaces, and, as all the tests were made with small furnaces, it is considered safe to assume that the operation of the larger furnaces will be even more simple than that of the small ones. Three moderately large commercial brass furnaces are now in course of erection, and, it is hoped, will soon be completed.

It was hoped that these commercial furnaces would have been in operation in time to give the numerical data of their operation in this paper, but it was thought best to postpone their final completion until the final tests had been made with the improved water cooling blocks and other details. It has been conclusively demonstrated and has been witnessed by many that the furnace will melt brass very satisfactorily, that it is simple in construction, that it is easy to manipulate, quick acting, easily repaired and, in fact, is a practical furnace on the scale on which it has been operated, and even on that unfavorable scale its power consumption is very encouraging.

TINNING ARTICLES OF BRASS, BRONZE, IRON AND STEEL

A Description of the Various Methods Employed for the Successful Performance of This Work.

By Charles H. Proctor.

Although electro galvanizing has superseded, to a great extent, the older method of coating articles of iron or steel by immersing in a bath of molten zinc, electro tinning has never been considered the equal of the older method of tinning by immersion in the molten tin bath, as the color of the electro deposit of tin appears to be more of the color of aluminum instead of the bright silver-like appearance that results from the coating by the hot process. Hence, it is less used. Frequently it is desired to give articles made from the metals mentioned a coating of tin for various purposes. For this reason I thought the article might be appreciated and herewith give in detail the various methods used, and I do not claim anything original in the article.

BOILING PROCESS.

By the aid of this process small articles made from brass are coated with tin to prevent oxidation. This is termed "whitening" and is used to a large extent for brass pins and brass corset trimmings and other small articles of a like nature. It is customary to use a tank made of wood for the purpose and lined with sheet brass. The tank should be of sufficient size so that 200 or 300 pounds of the material can be tinned at the same time. The reason for lining such tanks is to prevent action of the solution upon the wood, as the solution must always be maintained at the boiling point for successful results.

The heating is accomplished with lead coils, having an inlet and outlet valve so that the steam pressure can be regulated. A good-size faucet should be inserted at the bottom of the tank and soldered to the brass lining in a good substantial manner. All seams resulting from the lining of the tank should be soldered. The regular half-and-half solder of fifty parts of tin and fifty of lead may be used for the purpose. As soon as the tank is prepared and ready for operation it should be filled two-thirds full with clean water which is brought to a boil. Cream of tartar (potassium bitartrate) should be added to the boiling water until saturated. This will require probably 1½ pounds to each gallon of water. To this mixture should be added ¼-ounce of chloride of tin to each gallon so prepared. Sheets of pure Straits or Banca tin, 9 to 12 inches square, not less than ⅛ of an inch in thickness and punched full of holes 3/16 to ¼-inch in diameter,

should be immersed in the tank. The number of such sheets should depend upon the amount of material to be tinned. For a tank 36 inches long, 36 inches wide and 24 inches deep, fifty pieces would probably be required. These sheets of pure tin should be immersed as stated and the boiling carried on for at least five hours before the actual tinning operations are commenced. The reason for this is to dissolve as much metal from the tin sheets as possible, so that the metal will be deposited upon the articles almost immediately. After the boiling of the articles is started, unless the proper amount of metal is in the solution, the brass articles remain bright and refuse to coat over.

After the expired time, as noted, the solution is removed from the tank and placed in a clean barrel or any other receptacle that should be maintained constantly for the purpose. The articles to be tinned should be free from greasy substances and as bright as possible. Small articles are frequently tumbled in sawdust and then in macerated leather whenever possible. The lead pipes should be covered with brass wire netting to prevent the articles from coming in contact with the lead coil. This netting should then be covered over with the sheets of tin as mentioned. The sides of the tank should also be protected with tin sheets. A layer of the articles is then placed upon the tin to the depth of 2 inches or more, and then a layer of tin, another layer of articles and then a layer of tin, and so on until the tank is a little more than two-thirds full. The last layer should also be covered with tin. The solution previously prepared is now placed back again in the tank and the steam turned on. As soon as the solution comes to a boil it should be thus maintained from three to five hours, depending upon the amount of articles to be coated continuously. After the expired time the steam is turned off and the solution is drawn off and placed in the receptacle prepared for it. The articles, while still in the tank, are washed with clean cold water, removed and dried out by the aid of boiling water and maple sawdust. It is advisable to maintain the boiling rinsing water slightly soapy. For this purpose use from ½ to 1 ounce of platers' compound per gallon of water. This gives the articles a brighter tone and greatly aids in drying the articles out.

Contact Method for Brass, Copper or Bronze.

In using the contact method a greater amount of tin is deposited upon the articles. For this method of solution the same as given in the boiling process may be used, but the articles must come in contact with zinc. This may consist of pure sheet zinc of the same dimensions as for the tin sheets. The articles to be tinned are placed directly upon the zinc sheets, which may be made up in the form of pans. The operations are exactly the same as those followed in the boiling process, but the time of immersion is considerably less, as an hour or more gives a fairly good deposit. It is advisable to maintain a separate solution for the contact method. Small proportions of chloride of tin may be added to the contact baths to keep up the metallic content of the solution.

Contact Method for Iron or Steel Articles.

In tinning articles of iron and steel by the contact method the following formula gives good results:

Water	5 gallons
Ammonia alum	1¾ pounds
Chloride of tin	1½ ounces

The articles should be cleansed in the usual manner and placed in contact with zinc as previously stated, in the form of sheet or made into pans. The temperature of this bath need not exceed 160 degs. Fahr. For tinning by immersion without zinc contact, the solution should be maintained near the boiling point. Frequent additions of tin salt in small proportions are required to maintain the solution constant. As the contact baths produce dull white coating similar to unpolished aluminum, they can be polished by tumbling in bran, sawdust or macerated leather. Larger pieces can be scratch-brushed, using a soft steel wire brush for the purpose, run at a speed of 1,000 revolutions per minute. In bright polishing tinned articles with the buff wheel, whitening mixed with kerosene oil gives good results. This mixture will give a good color without cutting away much of the metal.

Electro Tin Baths.

The baths should be arranged as usual and provisions should be made for heating the baths. A small amount of common glue dissolved in boiling water and added in the proportion of .01 per cent. to any of the baths produces a more uniform deposit and allows a higher current density to be used. In all solutions anodes of pure Straits or Banca tin should be used, depending upon the cathode surface.

Solution No. 1.

Water	5 gallons
Caustic soda	5 pounds
Sodium sulphate	2½ pounds
Chloride of tin	1¼ pounds

To prepare the solution dissolve the caustic soda in part of the water, then add the tin salt. Dissolve the sodium sulphate in the balance of the water and mix thoroughly. The solution may be run cold or slightly warm and the voltage should be 2½ to 3 volts.

The following formula recommended by Roseleur is very frequently used and gives very good results:

Solution No 2.

Water	1 gallon
Pyro phosphate of soda	12 ounces
Chloride of tin	1½ ounces

Use the bath warm at three volts. Maintain the metallic content by adding chloride of tin immersed in the solution in cheese cloth bags. To prepare the bath dissolve the soda in part of the water which should be at a temperature of 180 degrees; then add the tin salt and the balance of the water. Cleaning and finishing manipulations as noted in solution one.

Solution No. 3.

Water	1 gallon
Ammonium oxalate	10 ounces
Chloride of tin	4 ounces
Oxalic acid	½ ounce

To prepare this bath dissolve the ammonium oxalate and the oxalic acid in half the amount stated of boiling water and the tin salt in the remaining part and thoroughly mix. The solution will at first be turbid, but will eventually clear up. If not a very small amount more of oxalic acid should be used. The voltage required should be 2½ to 3 volts. It is well to make provisions for heating the solution as this bath gives better results if the solution is boiled previous to using.

There are a number of other solutions that may be used for electro-tinning, but I have selected these as ones that will probably give the best results. Iron, steel, brass or bronze may be plated in the electro-tinning baths. In the boiling and contact baths the water lost by evaporation during the boiling operations should be replaced with either cold or hot water and frequent additions of cream of tartar should be made to maintain the strength of the solutions.

INITIAL STRESSES IN BRASS DUE TO COLD DRAWING*

An Explanation of the Mysterious Cracking of Copper Alloys.

A body or structure becomes subject to initial stresses when force is required to bring its parts together in a final position. Initial stress may, therefore, be defined as that stress which exists in a body when no present external force is acting upon it. The initial stresses which are introduced into materials during the process of manufacture are always a source of danger because they do not receive due consideration in calculating members and they are generally of unknown magnitude.

In certain cold drawn copper alloys, especially brass, the initial stresses often result in tears and cracks. This may be observed by dipping the cold drawn material in a solution of mercury or even in the metallic mercury. A rod of forgeable brass (Copper 57.80—Zinc 40.8—Tin 0—Lead 1.35—Iron and aluminum trace) was drawn from a diameter of 28 mm. to a diameter of 25 mm. without being annealed. The elongation was 26 per cent. A piece of this rod about 180 mm. long, which was completely free from cracks in the state of manufacture, was dipped into a solution of mercury-oxydulnitrate. After about 10 minutes this rod began to crack lengthways, with a loud noise, as shown in figure 1.

As the cracks begin on the outside and even gap on the surface the initial stresses on the outside must be tensile stresses while in the interior they must be compressive.

The outer part I, Fig. 2, must act or press like a shrunken-on ring, or band, against the inner part II. The outer part is therefore under tension and its diameter is elastically enlarged. If by boring out the resistance produced by the inner core is removed, then ring I can follow its tendency to assume a smaller diameter. This must show itself as a diminution of the outside diameter, da.

The following table shows that in the case of this brass rod such was actually the case. The experiment was made with a piece of cold drawn rod, about 50 mm. long, which was bored out gradually to the interior diameter, DI. After each boring the outer diameter was measured. The measuring was done with a screw caliper. The figures below are the mean of four measurements in different places:

	1st Boring	2nd Boring	3rd Boring
Diminution of..	d.4 mm.	d.10 mm.	d.16 mm.
Outer dia. da...	0.000 mm.	0.010 mm.	0.025 mm.

As after boring out 16 mm. the greater part of initial stresses ought to be removed or overcome, the cracking open of the remaining hollow cylinder should not

ENORMOUS MANGANESE BRONZE CASTINGS.

The manganese bronze casting shown in the above picture is known as a 72 inch riser cap. This casting, which measures 9 feet in diameter, has a 72 inch waterway with two 48 inch openings for connection to 48 inch manganese bronze valves which carry the water to the mains. The casting weighs 23,540 pounds and sets 30 feet under ground on the top of a cement lined riser shaft and just above a 72 inch riser valve. This casting is one of six similar 72 inch caps which are being used in connection with the Catskill System Water Supply for New York City. This particular casting is about to be set in place at Shaft 24, Fort Greene Park, Brooklyn, N. Y. In addition to these 72 inch caps there are twenty-five 48 inch caps which weigh 10,000 pounds each, distributed at various points in the water system. All of these 72 inch and 48 inch manganese bronze caps are being supplied to the water department by the American Manganese Bronze Company, Holmesburg, Pa., and 99 John street, New York.

These castings were furnished under Contract 84 and under physical specifications as follows:

Section 9. The minimum physical properties of bronze shall be as follows: In castings, ultimate strength, 65,000 pounds per square inch; yield point, 32,000 pounds per square inch; elongation, 25 per cent. In forged material, ultimate strength, 70,000 pounds per square inch; yield point, 35,000 pounds per square inch; elongation, 28 per cent. After being forged into a bar, rolled or forged bronze shall stand, first, hammering hot to a fine point; second, bending cold through an angle of 120 degrees to a radius equal to the thickness of the bar, without showing signs of fracture.

Section 11. All bronze shall be made of new metal, shall be free from objectionable imperfections and shall conform accurately to patterns. When any material is being machined, if the metal shows signs of imperfect mixing, it shall be rejected.

*An abstract from Martens-Heyn : Materialienkunde.

take place when dipping into the mercury salt solution. This was shown to be correct. Again, another piece of this cold drawn rod did not crack open after the outer layer had been removed by turning down to 15 mm. Cold drawing produces tensile stresses in the surface layer of a rod while cold hammering results in compressive stresses.

The author observed cases of cracking of cold drawn tin bronze as well as 25 per cent. nickel steel. This cracking took place either immediately after cold drawing or after a considerable time; sometimes after years and often without any apparent external cause. In most cases, however, the cracking may be traced to an occasioning external condition, such as:

(a) ADDED STRESSES RESULTING FROM MECHANICAL LOADS. The cold drawing raises the yield point in the outer layer of the metal and makes it almost equal to the ultimate strength. A moderate tensile stress resulting from an external load may, therefore, produce the unit stress in the rod which, when added to the initial

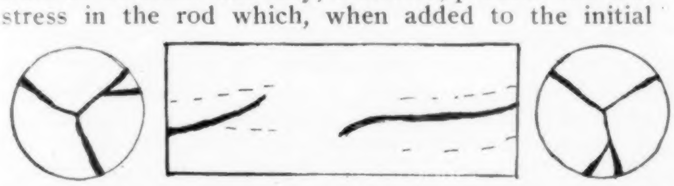


FIG. 1. SHOWING HOW BRASS ROD CRACKED WHEN DIPPED IN MERCURY OXYDULNITRATE.

tensile stress at the surface, may exceed the ultimate strength of the material, and since owing to its high yield point this outer layer is prevented from stretching and thus equalizing the stress, a crack will appear.

(b) CRACKING MAY BE OCCASIONED BY IRREGULAR HEATING OR COOLING. If the difference in temperature

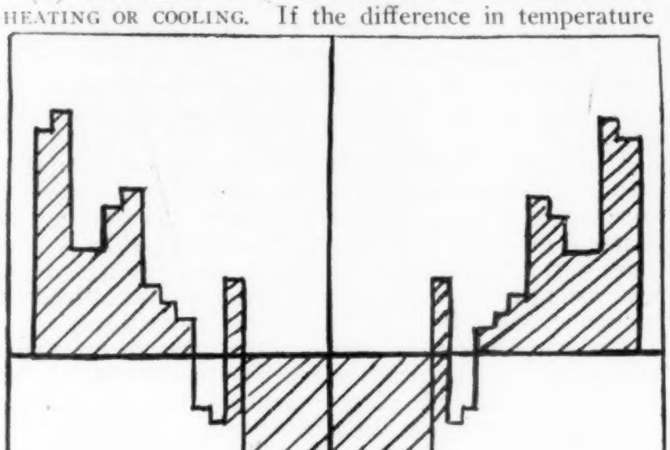


FIG. 3. SHOWING EFFECT OF STRESS BEFORE ANNEALING.

lasts only a short while and is equalized by thermal condition, the added stresses appear suddenly and disappear again. This acts like a blow on the metal. If these heatings are repeated frequently, then we get repeated stress which may lead to breaking.

(c) MECHANICAL OR CHEMICAL INJURY OF THE SURFACE BY MEANS OF WHICH THE UNIT STRESSES ARE INCREASED OWING TO A LOCAL REDUCTION OF THE CROSS SECTION. If the initial stress before the injury takes place is near the breaking point, a slight injury such as a scratch or deterioration by chemical action may cause a crack. It is especially mercury and its solution which have been observed to cause cracking in cold drawn brass and other copper alloys by attacking the outer surface of the metal. The cracking may also be caused by the corroding carbon-dioxide contained in the atmosphere, in

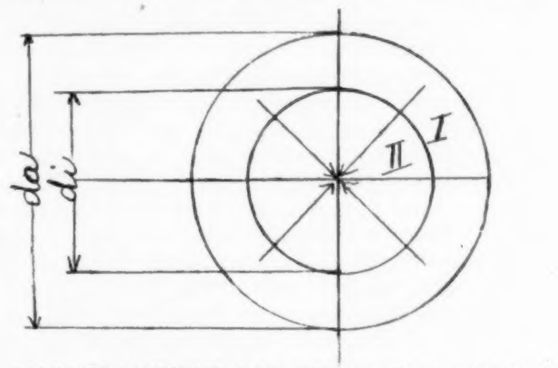


FIG. 2. DIAGRAM SHOWING HOW CENTER WAS BORED OUT TO RELIEVE STRAIN.

conjunction with dampness or ammonia fumes, if the metal is exposed to these fumes for any considerable length of time. Tubes painted with vermillion enamel were found cracked owing to the chemical action of the vermillion on the brass.

Initial stresses may be practically eliminated by annealing. In the case of cold drawn brass the effect of annealing may be noticed to a slight degree after the material has been exposed to a temperature of 400 degs. F. and will increase as the temperature is raised to 750 degs. F. Acid tests showed that samples annealed for three hours below 212 degs. F. cracked in dipping owing to remaining initial stresses, while samples annealed for an equal length of time at temperatures above 212 degs. F. did not crack. It would, therefore, seem in the case of this material that a slight annealing which would not bring about any material changes in the physical properties might so reduce the initial stresses as to make the material safe.

Cold drawing diminishes the specific gravity of most metallic elements. If before drawing they are absolutely free from porosity the specific gravity varies, therefore, in the different layers of cold drawn rods. Sometimes the specification requirements under which

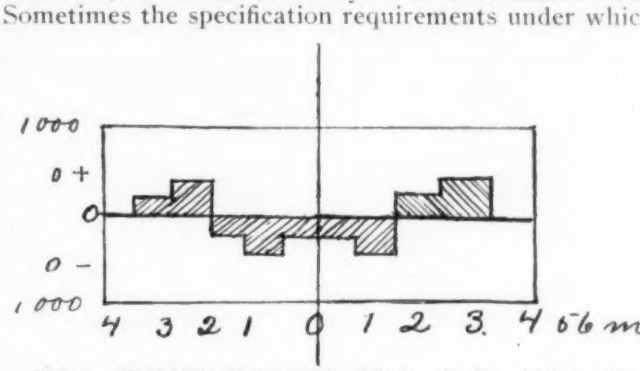


FIG. 4. SHOWING EFFECT OF STRESS AFTER ANNEALING.

materials are ordered are to be blamed for the existence of excessive initial stresses because they call for such high ultimate strengths and yield points as cannot be produced in any other way than by excessive cold drawing. The longitudinal initial stresses when measured in a bar of 25 per cent. nickel steel by successively turning off layers and making corresponding measurements of the length.

[The above article is printed with a view of accounting for the spontaneous cracking of the large manganese bronze rods furnished for the Catskill Water Supply System for New York City.—Ed.]

THE NON-FERROUS ALLOY TEST-SPECIMEN QUESTION*

Results of Some Experiments With Various Shapes of Test Bars.

By V. Skillman.†

The modern jobbing brass foundry, which caters to the more particular class of trade, is constantly called upon to furnish information regarding the physical properties of its alloys. Such information is usually wanted either in the form of data obtained by the foundrymen, or in the shape of test pieces from which data can be obtained by the customer himself.

In the former case it would be logical to assume, provided the foundry was producing the common and well-known non-ferrous alloys, that much of the needed data could be gathered from the rapidly increasing volume of literature dealing with such alloys. Anyone, however, who has had occasion to search the available literature for fairly definite information regarding the physical properties of the common brass foundry alloys, has, undoubtedly, been impressed by two things. First, the meagerness of the data to be had and, second, the worthlessness of much of the data found. The latter being due to neglect, either intentional or otherwise, to adequately describe the specimens from which the facts were obtained. This is the more noticeable the more conversant the searcher is with the factors which taken collectively determine the physical properties of an alloy.

A few months ago, a very good editorial in one of the foundry trade papers opened with the lament that the scientific papers read before scientific societies were objectionable mainly because of the fact that they were of no value to the practical man. To this may be added that many of the practical papers read before technical societies are of little use to the scientific man. This condition is often due to the fact that the writers of scientific papers are not sufficiently in touch with practical needs and limitations, while, on the other hand, the practical investigator and writer is quite likely to neglect a sufficient number of important variables to render his whole work of little scientific importance. In consequence much of the data found in the literature cannot be used and the foundryman must obtain it for himself.

The production of test specimens is then a necessity in any case and immediately calls forth this question: How are we to make test specimens which will best give the physical properties of an alloy? The properties desired may be only the tensile strength and elongation, or they may include the compressibility, electrical conductivity, heat conductivity, hardness, specific gravity, or a number of other properties, which would increase the difficulties of producing suitable test specimens. If we confine ourselves for the present to specimens, for tensile testing, the complicated nature of the subject can probably be sufficiently well shown.

As is well known, there are, broadly speaking, two methods of producing test specimens of an alloy. One is to cast the piece in a sand mold in the manner in which a casting of the metal would probably be made, and the other is to pour the alloy into a mold having a higher heat conductivity and made probably of metal. Which one of these methods will produce a test piece from which we can best determine the physical properties of the alloy? It must be understood that we are not looking for the method which will produce a test piece from which the highest results may be obtained, but we do want a test specimen from which sufficiently accurate data can be obtained for us to judge if the heat of metal it represents is above or below par.

Each method of procedure has its advantages and disadvantages. In discussing the subject the first argument usually put forward is that the sand cast test piece is preferable to the chilled one, as it more nearly represents the material when in the form of castings. The more closely we study the subject the more some are inclined to wonder if this is so.

Take as an example a casting in the form of a four-cylinder automobile crank case of good design poured from the usual mixture of 92 aluminum and 8 copper. If standard S. A. E. test bars for aluminum alloys are attached to the casting and the metal is poured at 1,300 to 1,350 degs. F., which would be a good temperature for such work, we should find, on breaking the bars, that they had strengths of from 18,000 to 20,000 pounds per square inch. If the crank case be then dissected and the strengths of various portions determined, we would find that the side walls 3/16 or ¼ of an inch in thickness had strengths in various places ranging from about 12,000 to perhaps 22,000 pounds per square inch. The former figure would be obtained close to a boss or heavy lug which held considerable heat. The latter figure would be obtained on material under or close to a chill. The greater part of the wall would have a strength between 15,000 and 17,000 pounds per square inch. A piece from a bracket or a brace which was about ½ inch thick would break under a load of 12,000 to 13,000 pounds per square inch, while other sections of about the same thickness, but so located that they were more slowly cooled, would only stand a strain of 7,000 to 10,000 pounds per square inch.

When such figures are arrived at through experience one cannot continue long before wondering if the sand cast test bar comes very much closer to representing the material in the casting than would a chill cast bar. The same sort of variations would have been encountered if the casting had been made of brass or bronze instead of aluminum and a different form of test coupon used.

Designing engineers should realize that the strength of a casting often depends as much on the design as upon the metal employed. Many engineers seem possessed of the idea that any given alloy, if properly compounded and cast, has a definite strength. To this figure, whatever it may be, is added a factor of safety, and the result is a definite value to be used in calculating the necessary thickness of metal in any casting made from the particular alloy. More consideration should be given to the fact that doubling the thickness of a piece of cast material seldom doubles the strength.

Since the strength of a casting depends so much upon the designer, we evidently cannot hope for any standard form of test coupon to do more than indicate the quality of the metal used, and it seems at times that a chilled sample would answer the purpose as well or better than a sand cast one.

Referring again to the aluminum crank case with attached test bars, if such a casting were poured at entirely too high a temperature the strength of the attached test bars would be materially lessened and the fact that the casting had been poured too hot would be indicated. It is a question if the chilled specimen of the alloy would do the same.

On account of the very rapid chilling which would

*Paper read at Chicago convention of American Institute of Metals, October, 1913.

†Metallurgist, Lumen Bearing Company, Buffalo, N. Y.

take place it seems likely that the effects due to differences in pouring temperature would be minimized and likewise the chill cast test piece would be incapable of showing other possible variations in foundry practice. This appears to be one of the greatest legitimate objections to the use of the chilled coupon.

There is another objection to its use which is its bad reputation. This is really unfortunate for the chill cast test piece, as its bad repute is really a result of its good qualities. Chilled test bars to give high results, and for that reason they have been and even now are being palmed off by unscrupulous founders onto unsuspecting purchasers, who are led to believe that such bars represent the material which they are or would be furnished in the form of castings. If they are not encouraged in such a belief, they at least are not prevented from believing so if they wish. In consequence, chilled test bars are said to give fictitious results when it should be said that they have at times been used to deceive. The bars themselves are not at fault and the objection to them on this ground can be dismissed.

In fact, more peculiar results can be obtained with sand cast test pieces than with those cast in a chill mold. The strength obtained varies widely with the pattern of the test piece. This was shown to be true for manganese bronze and a red brass by Jesse L. Jones in his paper on "Test Bars for Non-Ferrous Alloys,"* read before the American Institute of Metals a year ago. This great possible variation in the properties, as obtained from different forms of test pieces, of a single heat of metal, together with the fact that we have no standard pattern of test piece to use, is one of the great arguments in favor of adopting the chilled sample for the present at least.

Such a procedure would give us a test piece not influenced by variables such as pattern, method of gating, method of molding, quality, temper and fineness of sand, method of pouring, method of cooling, and the like. As long as we have no standard pattern for sand cast samples and the effects of these variables are no better understood than they are at the present time, we can only expect, as has been previously pointed out, to obtain from the test samples an indication of the quality of metal poured. Will not the chilled sample give this as well as any other form?

At the present time the writer is using both chill and sand cast test pieces. The results from the former are depended upon to give comparable figures to be used in judging different alloys and in determining the physical properties of a given alloy. If a single pattern of sand cast bar were used for this purpose, very good results might be obtained with one class of alloys, while poor results might be gotten with another.

The pattern of sand cast coupon, which gives very dependable tests with manganese bronze, gives with the standard No. 12 aluminum alloy a strength of about 15,000 pounds per square inch, while the standard S. A.E. bar would give 20,000. At the same time the S. A. E. bar, when used for manganese bronze, gives varying results on account of the difficulty of proper feeding, etc. Sand cast test bars are, however, also used by the writer and whatever information possible is obtained from them. But at best, it is variable and uncertain.

In spite of the publication of Mr. Jones and other similar papers, it does not seem to be very well understood that, in giving the strength of a sand cast alloy, it is also necessary to describe the form of the cast test piece, in order that the information may be at all complete.

*The Metal Industry, November, 1912.

Many are surprised at the varying results which may be obtained from one heat of metal when different patterns of test coupons are used. Perhaps the experiment has not been tried by many and some figures may be of interest. This data has all been obtained while carrying on other lines of investigation, and each table of results was obtained from a regularly melted foundry heat of a hundred pounds or more of metal. The melting and molding conditions were equivalent, we believe, to what is considered good brass foundry practice. The results are thus practical. The analyses were made on drillings taken from the chilled test bars. The patterns used may be described briefly as follows:

Pattern A. This is a cast to size bar such as is recommended for aluminum alloys by the S. A. E. It is ½ inch in diameter in the test section and is broken without machining with V-shaped grips.

Pattern B. This is the Clamer modification of the Reeves bar used for manganese bronze. It is a block 4½ inches long, 3 inches wide and 4 inches deep, carrying three test pieces 1 inch square and 4½ inches long. It is Jones' Pattern 28292-A.

Pattern C. This is an open iron mold which gives a chilled bar about 2 feet long and 1 inch square.

Pattern D. This pattern is barrel shaped, 4½ inches long, 1⅛ inches diameter at the ends and 1¼ inches in the center. A 3-inch riser extends nearly its entire length.

Pattern E. This is similar to D in shape, but is 12 inches long, 1⅛ inches in diameter at the ends and 1½ inches in the center. It is cast with a riser the same as D.

Pattern F. This pattern is 4½ inches long by ⅞ inch in diameter. It is gated at one end with a riser attached to the other. Cast horizontal.

Pattern G. The same as F, but 7 inches long by ¾ inch in diameter.

Pattern H. The same as F, but 8 inches long by 1 inch in diameter.

Pattern I. This pattern is 4½ inches long and the shape of a test bar with considerable allowance for finish. It is ⅝ inch in diameter in the test section and ⅞ inch at the ends.

All test pieces, with the exception of those from pattern A, were machined to the standard test bar size, 2 inches long in the test section and .505 inches in diameter, and pulled with threaded grips.

Table 1.

ANALYSIS: Cu. 89.15, Sn. 9.97, Pb. 0.12, P. 0.41.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
C	8	50,500
A	5	32,300
A	6	34,200
F	3	27,000
F	8	31,500
H	4	24,000
H	2	18,500
I	2.5	22,500

Table 2.

ANALYSIS: Cu. 88.53, Sn. 11.08, Pb. 0.13, P. 0.18.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
C	10	51,500
A	7	35,000
A	7	37,800
A	9	36,700
F	12	34,500
F	13	34,500
B	13	28,500
B	11	27,500
E	8	27,500

Table 3.

ANALYSIS: Cu. 82.78, Sn. 9.37, Pb. 7.20, Zn. 0.47, P. 0.20.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
A	11	33,200
A	9	31,000
A	7	28,000
D	4	17,750
B	10	22,750
B	5	15,500

Table 4.

ANALYSIS: Cu. 79.07, Sn. 11.47, Pb. 7.16, Zn. 0.53, Sb. 0.5, P. 0.92.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
C	1	46,500
A	1	26,200
A	1	27,200
G	1	24,500
H	1	21,750
H	1	20,950

Table 5.

ANALYSIS: Cu. 87.55, Sn. 10.10, Zn. 2.27.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
A	38	51,500
A	40	51,800
F	21	38,000
F	33	42,000
H	29	39,000
H	24	38,500
I	40	46,500

Table 6.

ANALYSIS: Cu. 86.78, Sn. 8.81, Pb. 2.12, Zn. 2.42.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
C	17	48,000
A	41	46,600
A	29	44,600
F	22	35,000
F	28	37,500
H	27	36,000
I	32	41,000
I	36	42,000

Table 7.

ANALYSIS: Cu. 83.68, Sn. 5.06, Pb. 5.03, Zn. 5.47, Sb. 0.35.

Bar Pattern	% Elong. in. 2"	Tens. Str. per Sq. In.
C	15	40,000
A	16	32,350
A	15	31,600
A	20	35,500
D	8	21,000
B	26	32,500
B	27	33,000

No attempt will be made here to draw any conclusion from the above data, as it is given simply to emphasize the pressing need for some settlement of the non-ferrous alloy test specimen question. The problem is entirely too large and would prove too costly for any commercial concern to undertake its solution. We may be considered exceptionally fortunate, therefore, in having the able assistance of the Bureau of Standards in the work. The subject is well worth the consideration of all, from both technical and commercial viewpoints.

This paper has not been presented as an advocate of the use of any particular form of test specimen, but is simply an addition to the open discussion of the test bar problem.

The writer wishes to thank the Lumen Bearing Company for permission to publish much of the data given, as it was obtained as a side issue in the course of other investigations carried on in their laboratories.

CLEANING OIL FROM COLD ROLLED STEEL.

By Wm. F. Voss.*

Cold rolled steel sheet is, as a rule, coated with a heavy gummy oil in order to prevent rusting while in shipment, and this coating of oil platers sometimes have trouble in removing. Some firms keep this metal in stock for months before it is required for use and consequently the oil dries in hard lines throughout the sheet, and when the metal is cut up and manufactured into articles, these lines of hard oil will still remain and after become harder owing to the extra exposure to the drying influence of the air. Soaking in potash takes some time to dissolve these oil lines and even when the oil is all dissolved off and the article has been run through an electric cleaner the lines are still visible and cause trouble in plating.

Upon taking charge of the plating department of a concern manufacturing builders' hardware I found that they had always had trouble in removing this hard oil. The first thing the superintendent told me to do was to try and eliminate the use of such a large amount of benzine and gasoline, as the insurance company had objected to it and wished to raise the insurance rates. I discovered two boys scouring the metal, using ground pumice stone and gasoline and finishing about one thousand pieces per day. This method was considered too slow and, as "quantity counts as well as quality" in the hardware line, I decided that it was up to me to get busy. I ordered a barrel of kerosene and secured a tank to hold it; I then had baskets made of a suitable size from strong wire mesh to hold and dip the work. The work was soaked in the kerosene for five minutes and allowed to drain for a minute or two; a boy then brushed the pieces on an eight-inch Tampico brush wheel at a speed of 1,500 revolutions per minute.

This method of brushing took off all the hard oil which had been softened by the kerosene, leaving a clean, bright surface. I then set a working time of 10,000 pieces per day and found that the boys could make 100 per cent. on the job with less elbow grease than was required for the old way of doing things. I then proceeded in the regular way of racking the work, and swishing through strong potash, then through the electric cleaner, then through a weak acid dip, washing off thoroughly in clean running water, then into the plating vats. I had excellent results with this method of cleaning, got rid of gasoline and benzine, saved the difference in price between gasoline and kerosene, satisfied the insurance people and my employer, and, last but not least, I was satisfied myself. After explaining this method of cleaning to several plater friends who have had the trouble with this "varnish oil" (as they called it), they said they had never thought of doing it that way before.

I hope that this article on cleaning cold rolled steel will be of some benefit to the readers of The Metal Industry who have had the same trouble cleaning hard, dried oil from cold rolled steel.

PHOSPHOR BRONZE FOR SARATOGA SPRINGS.

Dr. Paul Haertl, director of the chemical and balneological laboratory at Bad Kissingen, Bavaria, has made an investigation of the mineral springs at Saratoga, N. Y. This investigation was made in connection with Governor Glynn, who called for economy in the State expenditure. Dr. Haertl reports that with proper care the mineral waters saturated with carbonic acid gas would be exhaustless. He recommends the immediate installation of phosphor bronze tubing for the spring and wells.

*Foreman Plater, International Register Company.

THE MANUFACTURE OF LARGE SEAMLESS METAL TUBES

A Short Description of the Production of Brass and Copper Tubes of Great Weight and Large Diameters.

By L. J. Krom.

Seamless tubes made by what is known as the cupping-up process are manufactured of both brass and copper and are employed for a great many uses. Perhaps the widest field in which we find demand for large seamless brass and copper tubes from, say, 8 inches in diameter up to 32 inches, is for the manufacture of hot water boilers, coffee and tea urns, pump linings, steam or other pipe systems in sugar refineries, pulp mills, bleacheries, dye houses, mines and, in fact, for any duty where corrosion renders the use of iron and steel unfit.

The picture, Fig. 3, shows some of these seamless tubes which are 24 inches in diameter and 12 feet in length. The ones standing upright are of copper, while those on the floor are brass. The process employed in producing these tubes is practically the same, whether they are made of brass or copper. The manufacture of brass tubes, however, by this process is confined practically to mixtures which will work both hot and cold, as the initial preparation of the metal for the cupping-up process is done hot, while the reducing and forming of a tube is done cold. Large seamless brass tubes, therefore, usually contain from 60 to 61 parts of copper and 39 to 40 parts of zinc, though, of course, it would be entirely possible to make these tubes from any mixture of brass that will stand the initial rolling of the ingot.

The photograph, Fig. 2, shows in a comprehensive way the method of producing a seamless metal tube which will finish 8 inches and over in diameter. Referring to the photograph, (a) represents a cake of copper or brass which will weigh approximately a thousand pounds and which may be from 24 to 30 inches in diameter and from 5 to 6 inches thick. This cake, if it is of copper, is obtained in this shape from the copper refinery, and if it is of brass is usually cast in the tube company's own casting shop, being poured into an iron mold open at the top and coated with a mixture of lard oil and graphite or clay to prevent the metal from sticking to the mold. The ingot or cake is first put upon the table of a boring mill and the top surface of the cake is turned off until a fine, smooth surface is obtained, all pits and scabs thus being eliminated. The ingot is then hot rolled on a pair of 66 to 72 inch hot rolls into a sheet having a gauge which has been predetermined upon, according to the length and gauge of tube that it is required to produce.

VIEW IN SEAMLESS TUBE MILL.

The sheet of metal is then put upon a circling machine and cut into a circle or disc, which, as in the case of the disc in Fig. 2 at (b), has a diameter of 66 inches and is ¾ of an inch in thickness. The metallic disc or circle is now ready for the cupping-up process, the various stages of which are shown in Fig. 2 in c. d. e. f; and g being the finished tube of 16 inches in diameter and about 3 feet long. A tube made in this way but 32 inches in diameter and 4½ feet long is shown on its truck in Fig. 4. The only limit to the finished length and thickness of these tubes is, of course, the initial size and weight of the cake of metal started with.

The machine upon which these large tubes are made is a gigantic horizontal draw bench operated by hydraulic power; the dies are made of cast iron and hardened except finishing dies, which are steel. The punches are

made of chilled iron and ground. The initial reduction of the disc or circle into the first cup or shape, as shown in Fig. 2, gives a shape 38 inches in diameter and 18 inches deep. The shape is then annealed in a muffle furnace and cleaned from its resulting scale in a pickling solution of sulphuric acid (1 part to 10 parts of water), and after being rinsed off is ready for the next pass through the drawing machine. The passes following the first reduction, as shown in the picture, reduce the cup to 32, to 26, to 20 and to 16 inches in diameter, at which stage the cup has developed a length of 3 feet. The shells, of course, are annealed and pickled after each of these draws.

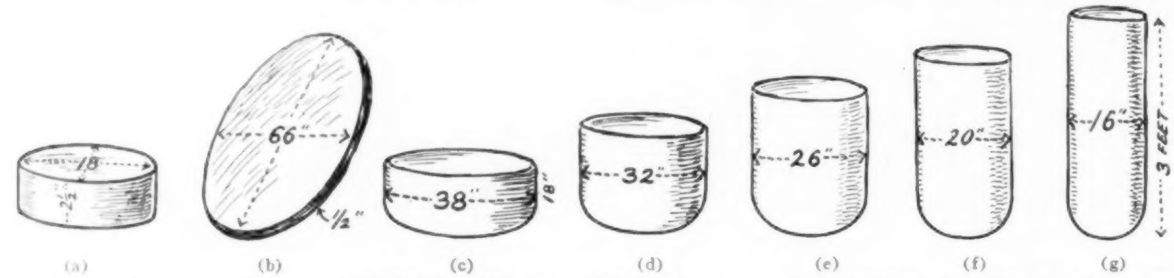


FIG. 2. a, CAKE OF COPPER OR BRASS. b, THE DISC READY FOR "CUPPING." c, d, e, f, g, VARIOUS STAGES OF DRAWN SHELLS.

If tubes of smaller diameters are needed, the operation would, of course, be continued to 12, 10 or 8 inches in diameter or to such sizes or intermediate diameters necessary to make the tubes wanted. In the operation described above no attempt is made to draw and reduce the thickness of the metal in the walls of the shells, this being, at each stage, the same as the original thickness of the blank. In this manner short lengths of tubes are produced with thick walls, suitable for bands for the largest projectiles or for other purposes. It is obvious that the reducing operations can be arrested at any diameter and by a succession of draws performed on the same mandrel, the shells will be elongated into a tube having a solid end which is sawed off if desired and the finished tube will nearly equal in weight the blank from which it was formed. The length of such a tube is determined by the thickness of metal in its walls.

By this method it will be seen that drawn seamless tubes having great strength can be more economically produced than by any method now in practice. This process of tube making is not confined to tubes of large diameters only, but the reduction can be continued down to 10 and 8 inches in diameter with success. A line of brass tube was made for conveying mail 10 inches in diameter with an extraordinary length of 20 to 24 feet per tube. This line of tubing is now in use as a pneumatic mail tube system for the New York Postoffice. The machinery with its tools for manufacturing seamless tubes by the cupping-up process was first designed in the United States and worked up by Ferdinand Deming, of Waterbury, Conn., who has devoted his entire life to the development of the large seamless tube business. Mr. Deming also first devised a method of making seamless tubes in a centrifugal mold, a process which has since been patented.

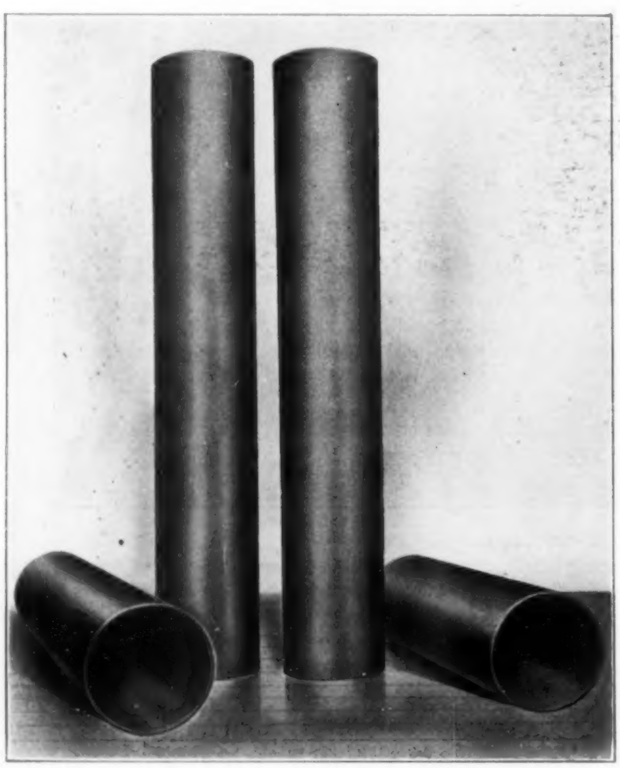


FIG. 3. BRASS AND COPPER SEAMLESS TUBES 24 INCHES IN DIAMETER AND 12 FEET LONG.

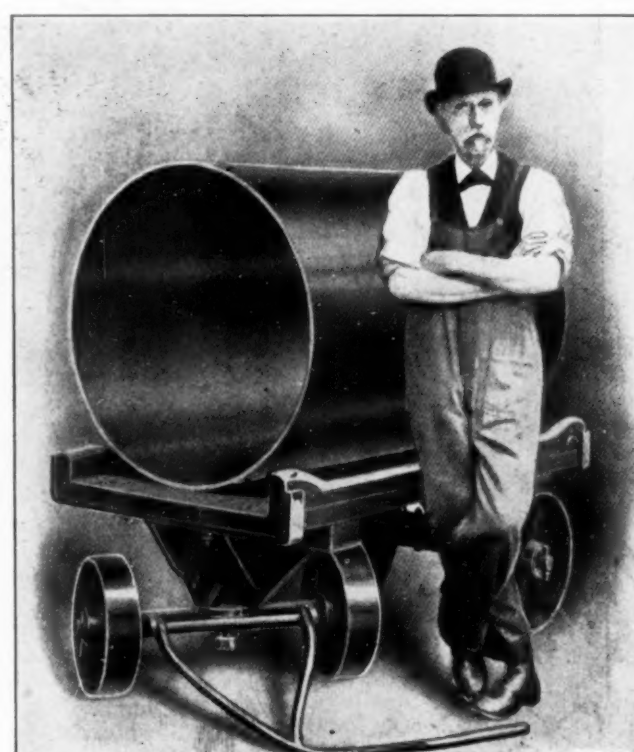


FIG. 4. COPPER SEAMLESS SHELL 32 INCHES IN DIAMETER AND FOUR FEET LONG WITH SUPERINTENDENT NETTLETON, WHO DREW IT.

SIMPLE FORMULAS FOR THE PRODUCTION OF SPECIAL FINISHES

Some Advice Which May Prove Useful to Beginner and Expert Alike.

By A. A. Le Fort.*

In this article I explain the finishes as I produce them for the Pass and Seymour, Inc., of Solvay, N. Y., manufacturers of handy electrical devices, which include shells, sockets, shade holders, etc., and name the finishes as they are on our sample boards, and, as H. E. Willmore states in his article in the January number of The Metal Industry, the names of the finishes might not mean the same to some platers, still the different samples of other manufacturers of this line of goods are about the same as we are using, so I hope there will not be any confusion on that score.

CLOISTER.

Under this heading will be found acid bronze, hardware bronze, Japanese bronze and statuary bronzes. The only differences are, the cloister is a medium shade of brown, while the acid and hardware bronzes are darker, and Japanese and statuary a few shades lighter, and are produced by plating articles in cyanide copper solution for about ten minutes, scratch brushed, then dipped in a very weak solution of liver of sulphur, not over two ounces of the sulphur to ten gallons of water, used hot, dry articles in sawdust, and finish by brushing dry, on soft brass wire wheel.

ANTIQUE BRASS.

Clean articles as for plating, then dip in the carbonate of copper and ammonia solution; use hot or cold; a hot solution works faster, but does not last as long as when used cold, as some of the ammonia is lost by the heat, and dip has to be strengthened oftener than when used cold. Medium and small articles can be dipped in baskets, thus doing away with the time spent in racking up. Articles are then relieved with pumice and water on a suitable brass wire wheel.

OLD ENGLISH BRONZE.

This is produced the same as "Cloister," only the shade is very much darker.

ANTIQUE COPPER.

Plate articles in cyanide copper for about 15 minutes, dip in hot liver of sulphur solution one ounce to the gallon, to which a little ammonia has been added; relieve the same way as for antique brass.

OLD COPPER.

Copper plate articles, then finish with water and pumice, the same as brush brass; also is oxidized the same as antique copper, but more of the black is scoured off.

MOTTLED AND OXIDIZED COPPER.

Copper articles, dip in liver of sulphur solution, one ounce to the gallon if used hot, two ounces to the gallon if used cold. Either brush articles on soft brass wheel, or color on soft rag wheel; oxidized copper is then spotted off on a cotton buff, using white lime composition. The mottled copper is finished with a narrow felt wheel, also using the lime, and is produced by cutting off the black by a (zigzag) motion of the article, going the length or width of the same.

OXIDIZED BRASS.

Dip articles in the copper and ammonia solution, then color and spot off the same as oxidized copper.

POLISHED GILT AND RICH GILT

are produced by polishing brass to a high lustre, then sprayed with a lacquer previously colored with either rich gilt or gold coloring, using more of the coloring for the rich gilt.

BUTLER'S OR GROUND SILVER.

Plate articles in silver solution, then brush on brass wheel, using water only for the butler, and pumice and water for the ground silver.

BAUER BARFF AND WROUGHT IRON.

If articles are of steel, lead, britannia, etc., plate in cyanide of copper bath, then color in liver of sulphur dip. Brass has only to be blackened in the copper and ammonia dip, then spray on one coat only of dead black lacquer.

FLEMISH BRASS.

The cheapest solution for this finish is the arsenic solution, composed of muriatic acid one quart and white arsenic one ounce. Dissolve the arsenic by heating the acid, then add water to make ten gallons and add about two ounces liver of sulphur to solution; use hot. Relieve with pumice and water. Scour articles before dipping; after dipping keep articles in water to which has been added a little sal soda or soap bark to prevent staining, until ready to relieve.

GUN METAL ON BRASS, COPPER OR SILVER.

Muriatic acid one gallon, white arsenic three ounces, dissolved in hot water, and one pound of cyanide potassium; add enough cold water to make up five gallons. Use copper anodes and low current; renew with arsenic and muriatic acid. Finish on soft buffing wheel, using a white lime composition. Articles of brass are also finished in gun metal by dipping in the ammonia and copper, and finished also with lime composition.

POMPEIIAN BRONZE.

Sand blast or satin finish articles, copper plate, then finish in a dark statuary bronze, lacquer, then make a mixture of carbonate of copper, linseed oil and copal varnish, daub color in the back ground, and wipe off high lights with a soft cloth and a little turpentine before color sets too hard.

FRENCH BRONZE.

Copper articles, then dip in solution of carbonate copper one-half pound, sulphate copper one pound and water one gallon. Use hot or cold. Scratch brush, then repeat operation until the desired color results.

POLISHED STEEL ON BRASS.

Plate for a few minutes, or until articles are well coated, in a solution of water one gallon, white arsenic five ounces, caustic soda eight ounces and cyanide of potassium three ounces. Use sheet iron or copper anodes, and weak current; if current is too strong, black will flake off. Finish on a fine brass scratch brush on slow lathe.

OXIDIZE ON BRASS OR BRONZE PLATED WARE.

Water one gallon, aqua ammonia one pound, golden sulphurette of antimony one and a half ounces; use hot; brush on fine brass wheel, then spot off.

STATUARY BRONZE ON BRASS.

Scratch brush articles, then dip in the following solutions: Solution No. 1, five ounces liver of sulphur

*Foreman plater, Pass and Seymour, Inc., Solvay, N. Y.

and water ten gallons; solution No. 2, one-half pint sulphuric acid and water ten gallons. No. 1 solution must be kept hot. Dip articles in No. 1 for 30 or 40 seconds, then in No. 2 without rinsing, then back again in No. 1, then in No. 2; repeat operation until the desired color is produced, dry off in sawdust, then finish on scratch brush.

OXIDIZED SILVER.

Plate articles, then dip in a very strong solution of liver of sulphur, and very hot, so that articles are colored in a few seconds, especially lightly plated ware, as this dip eats up and into the silver if kept in solution too long a time, and work will be almost impossible to finish decently. For a dark oxidize on plain work, brush lightly, then spot off, the same as ox copper; for lighter shades, relieve with pumice and water on a bristle or fine tampico wheel. Another method for oxidizing on silver plated brass is to plate articles lightly, then cut through silver to the brass on scouring wheel with pumice, or on rag wheel with lime composition or white diamond rouge, wash work, then dip in the ammonia and copper dip, which will not color the silver, and give a good black on the relieved brass parts; finish wet on scratch brush.

VERD ANTIQUE.

I have tried several formulas for this finish, and have never found one that could be called satisfactory, that is on plain work, where a good even verd is required. For work where the greens are only wanted in the background, the solutions of sulphate of copper and bichromate of potassium give fine results, as the coloring is easily brushed off of the high lights, and leave a fine color in the figures. What I find the easiest way of producing these finishes on plain work is as follows: For brass goods, color articles in the ammonia and copper dip; for other metals, copper plate, then oxidize, then use verd enamels, which can be procured of most lacquer manufacturers in any shades required; then simply daub on the enamel over the blackened articles and stipple with a paint brush, to make uniform; after articles are dried, they can be brushed with a little wax on a bristle wheel if a gloss is desired. This enamel process is much easier than the carbonate of copper and copal varnish finish, and much smoother and cheaper to finish.

In concluding I wish to explain for the benefit of some of my fellow platers who might be having trouble in oxidizing copper, that is, by the oxidize streaking or flaking off, especially on large plain work, that if they use a copper solution that will deposit a coarse grain, they will overcome their troubles. A copper solution that carries sodium bisulphite and is low in metal will deposit too bright and too close a grain, and is the cause of the trouble, but if the solution is kept well up with cyanide and copper, no trouble will occur, either in the hot or cold sulphur dips. But I prefer a cold dip with a little addition of ammonia, and made up of between two and three ounces of liver of sulphur to the gallon of water. Take articles out of the solution, rinse in cold water, then dip without brushing in the oxidize, dry off in sawdust, scratch brush on a very fine brass wire wheel and then spot off in the usual way.

LOSSES IN THE ASSAY OF COPPER RESIDUALS

A Few Suggestions for the Accurate Determination of Metal Contents in Slags.

By Ernest A. Lewis, F.C.S.

Some little time ago it was pointed out to the writer that in the assay of copper slag by the method adopted by most English smelting works and used by most practising assayers, a serious loss was likely to be incurred owing to the residue of silica, gangue, etc., left after dissolving in acid, containing copper, and it was the same no matter how fine the material was ground up before analysis.

The usual method of extracting the copper from the brass ashes or slag sample as received from the smelters is to dissolve it (in the proportion of metallics and fines) either in aqua regia or nitric acid, the residue being assumed to be free from copper and thrown away. The writer has proved experimentally that in the case of brass ashes and copper slags this residue contains from 0.25 per cent. to 1 per cent. copper, and in these days of keen competition this is a serious loss on large parcels. It follows that if, as is usually the case, the smelters and seller's assayers do not take special precautions to recover this loss that their assays will be low, although they will both agree with one another and the seller will be the loser.

The method the writer adopts for reference assays and other very accurate assays is as follows:

The sealed sample from the smelters is dried in the steam oven for 3 hours and weighed. It is ground up to go through a 60 mesh sieve. The metallics are separated and weighed. Ten grammes of the proper proportions of fines and metallics are weighed out into a 500 c.c. flask and treated with 20 c.c. nitric acid, and when the action has ceased 60 c.c. hydrochloric acid is added and evaporated slowly down to dryness. When cool it is treated with 40 c.c. hydrochloric acid and the mass is warmed until it is loosened from the bottom of the flask; it is then boiled to remove nitrous fumes, then about 100 c.c. hot water is added and boiled for 10 minutes.

The insoluble residue is filtered off on a filter and well washed with hot water, using as little water as possible, the filtrate being caught in a 500 c.c. Yena lipped beaker containing two thin sticks of zinc rod about 2 inches long to precipitate the copper, which is filtered off after digesting for about one hour, adding more hydrochloric acid if necessary to nearly dissolve the zinc; the copper is well washed with hot water and dissolved in nitric acid. After making up to 500 c.c. in a measuring flask, an aliquot part can be titrated for copper by the "Iodide" assay or estimated electrolytically. The insoluble residue is dried and fused with an excess of sodium carbonate in a large porcelain crucible (a common crucible is good enough) in a muffle. When the fused mass is tranquil take the crucible out of the muffle and let it cool. It is best stood on a roasting dish. When cold break it up in an iron mortar (after removing as much of the clean crucible as possible) and pound it up until the lot goes through a 60 sieve. Transfer it to a 500 c.c. flask and treat again with nitric and hydrochloric acids. After taking up with hydrochloric acid and filtering, neutralize some of the acid with NH_4OH and pass H_2S for one hour to precipitate copper in the solution, which must be slightly acid. The precipitate of CaS is filtered off and dissolved in nitric acid and $KClO_3$ (if necessary). The copper can be estimated volumetrically by adding ammonia to a deep blue color, boiling (if necessary, filter off any iron) till ammonia is removed. Then add a few

drops hydrochloric acid to clear the solution, cool, add sodium carbonate solution till precipitate forms and then 2 c.c. acetic acid (1:1) to clear, add 3 grammes potassium iodide and titrate with "Hypo" solution. On a 10 gramme assay from 2 c.c. to 10 c.c. or even more of Hypo (1 c.c. = .01 gramme copper) are often required.

On large parcels this loss has a considerable money value, especially with poor quality slag. A similar loss occurs in the assay of tin ashes and tin ores, the residue after reduction in hydrogen and dissolving out in acid frequently contains tin, but this metal being more expensive than copper, most assayers determine this loss.

THE NICKEL PLATING OF STOVE CASTINGS

A Practical Article on the Finishing of Iron and Steel.

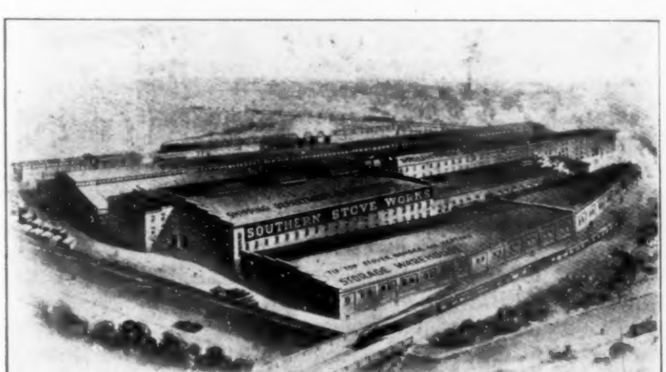
By Joseph Walters.*

JOSEPH WALTERS.

PREPARING THE WORK.

I take castings from the foundry, or more properly speaking, from the mill room where they were thoroughly milled or tumbled, and proceed to polish. First, I scratch-brush on a steel wire circular scratch-brush to remove any sand which may have been left from tumbling and to brighten the background. Second, I rough out on a canvas wheel covered with No. 20 emery. Third, go over again on a universal wheel covered with No. 120 emery. Fourth, go over again with a grease wheel, a felt wheel also covered with No. 120 emery with a little oil applied with a rag, twisted or rolled into shape for handling. Fifth, go over the final finishing on a worn out No. 120 emery covered felt wheel. This last operation should give a smooth mirror-like finish.

From the polishing room they are brought into the plating room, wired, and hung in a concentrated solution of hot lye for from five to ten minutes, or longer when necessary; taken out, rinsed in a tank of running water, then dipped in a solution of Muriatic acid containing two to four parts of water, showing a density of from six to eight on the hydrometer; rinsed again in water and scoured with a bristle brush, using the fine burned moulders parting sand that comes out from the mill or tumbling barrel of the foundry, and immediately

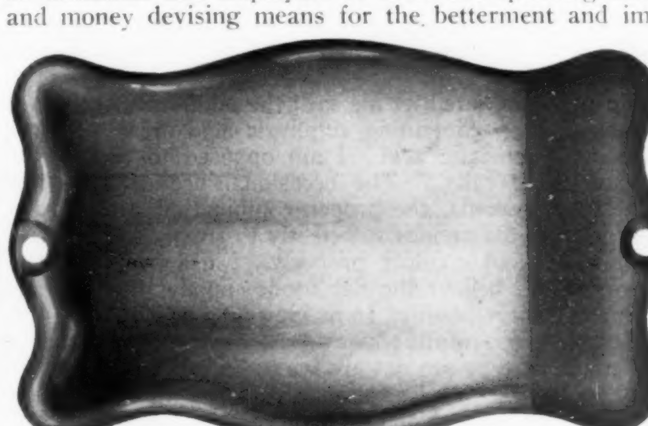


PLANT OF SOUTHERN STOVE WORKS, RICHMOND, VA.

hang in the nickel tanks. Notice please, I do not pickle my castings previous to polishing for removal of scale and to soften them.

I did it when cupola practice was not recognized as a science as it is today, and when castings were made as the nickel plating of days gone by was done—by guess work. Castings were made no two heats alike, soft one day, hard and brittle the next, and from extremely soft to case-hardened. Today the mixing of iron, and cupola practice has become a recognized profession, and the practical foundryman knows how to produce the proper castings, nearly always alike in hardness. And if he does not, I for one, as a plater, object to correcting the faults and incompetence of the foundry by pickling castings to soften them. I object to it for two other reasons: First, from an economical standpoint; and, Second, from a sanitary consideration. Experience has proven to me that while polishers will produce from fifteen to twenty per cent. more with pickled castings, the cost of acids and extra men employed to do it, with wear and tear and destruction of clothes, will more than overbalance the saving.

And what about the health of the men in the pickling room? It matters not how well ventilated a room, how good a gas and fume exhaust installation one may have, one cannot entirely and completely eliminate the dangerous and deadly vapors and gases arising from the pickling of iron. I am informed by reliable authorities that life insurance is refused to men engaged in this work—the risk is too great. Manufacturers, managers of industries and employers of labor are spending time and money devising means for the betterment and im-



SAMPLE OF STOVE PLATE NICKELED.

provement and health preservation of its employees. We are living in an age when most of us realize the truth as taught in the Good Old Book—That every man is his brother's keeper—and it is the duty of the foreman-plater to minimize the danger and injury to health of the men under his supervision. You will notice also that I do not use pumice stone for scouring, and I can almost see the astonished look in the faces of some platers,

*Foreman plater, Southern Stove Works, Richmond, Va.

asking, "Doesn't the sand scratch the work?" No, brother, it does not. The parting sand of the foundry, after it has been burned and tumbled with castings, loses all of its sharpness, and the roughness has been taken out of it. The amount of nickeling done by my firm would require about twenty-five cents worth of pumice stone per day, and during the ten years I have been with this firm I have saved them at least fifteen hundred dollars on this item.

PLATING THE GOODS.

Now for the nickel plating. I have several five hundred gallon tanks. The solutions were originally made with double nickel salts only, nothing else added, but its density was 8 degs. Bé. I give from one and one-half to two hours plate, using a stronger current to begin with and finish with a weaker one, using three volts at the beginning and from two to two-and-a-half the rest of the time. When done the articles are taken out, rinsed in cold water, then in hot water to dry, and buffed on a cotton or felt wheel as required. When I took charge of the plating department for this firm I found the nickel solution registering 15 degs. Bé. I was astonished and still more surprised that it performed excellent work. It plated rapidly a coat of a pure white color and that was adhesive. I kept it so for several months without any trouble, but when winter came it began to crystalize. Since then I have kept its density from eight to ten. I add about an ounce of sulphuric acid weekly to each tank, with an occasional addition of double salts and but seldom single salts. Every few weeks I stir my solutions so as to have the same density in the higher and lower strata of the bath. I filter my solution twice a year. I have used salt when I could not get ammonia, and the nickeling had to be gotten out on time, and the solution needed conductivity, but I object to its use for this reason:

First.—To nickel solution containing free sulphuric acid (H_2 SO_4) add Aqua Ammonia, result: (Sulphuric Acid) H_2SO_4 + (2 Aqua Ammonia) 2 NH_4OH = (Ammonium Sulphate) $(NH_4)_2SO_4$ + (Water) 2 H_2O.

Second.—Add Sodium Chloride (common table salt), result: (Sulphuric Acid) H_2SO_4 + (2 Sodium Chloride) 2 NaCl = (Sodium Sulphate) Na_2SO_4 + (2 Hydrochloric Acid) 2 HCl.

To the uninitiated let me say: the addition of salt to a nickel solution containing sulphuric acid creates hydrochloric or muriatic acid. I am opposed to the use of the nickeling salts. The occasional use of sulphuric acid and ammonia, the proper combination of the two, will dissolve the anodes sufficiently to supply the solution with metal and conduct properly. I use oval and flat anodes, but I believe the flat anode supplies the solution with metal more readily. In making up a new solution the hydrometer and litmus paper are necessary, but in testing old solutions they are not always to be relied upon. Let me cite an instance I experienced, and I think this has happened to other platers. The solution in one of my tanks did not work to suit me, I tested it with litmus paper and hydrometer. Red litmus paper turned blue; hydrometer registered seven and one half. Did I use acid? No, but added sulphate of ammonium. Why? Because by noticing the color of my work and the action of the solution under current I was convinced that it needed conducting salts. And the hydrometer, I say, is not always to be relied upon in testing old nickel solutions, especially when it has never been filtered. In the course of one, two or three years a quantity of impurities—iron, dirt and whatnot—accumulate in the solution. Then it is not really the metallic contents that the hydrometer registers, but foreign substances. The same is true of the litmus paper. Red litmus paper turning blue in an old solution does not always prove that the solution is in a good conducting state because it is alkaline. The action of the solution when plating and the appearance of the work tell me the condition of the solution better than litmus paper and hydrometer.

I am not much impressed with the claims made by the dealers of the new rapid plating salts, said to save from one third to one half the time in producing the same thickness of nickel plate. While I believe that the majority of platers are willing to learn and to test anything new, yet, as most of them know little of chemistry, I would advise them not to use anything they do not know the composition of, and not until the new salts have been analyzed and their properties known, will we know of their superiority or inferiority to the old and simple double nickel salts. The secret and patented salts for plating is what I object to. I don't believe in hiding the light under the bushel.

I am never troubled with pin-holeing or pitting of my nickel, so much complained of by platers, as my sample for your inspection will prove, and I believe its cause is due to the following reasons: Too little metal; too much current; to the use of salt, and to the impurities and foreign substances in the solution. I avoid as much as possible plating small objects and large ones in the same tank at the same time, for the reason that it requires a weaker current for small pieces than for large ones, and when they are plated in the same tank, using sufficient current for the large pieces to plate properly, the small ones will plate too fast or burn, and if the current is made weaker for the small ones to plate properly, the large ones will not, and this is one sure cause of pitting.

As soon as the articles are hung in the tank they should immediately be covered with a light coat, and no trouble will be experienced. Of course the solution must have the proper amount of metal; the proper amount of acid, and, above all, *it must be a good conductor*. It matters not so much what is used in a nickel solution—sulphuric or boric acid; aqua ammonia or sulphate. But to keep it in first-class condition remember always to make sure what it needs, then add to it the right amount at the right time. Upon these three hang all the Law and the Prophets of good nickel plating.

AMERICAN BRASS COMPANY REPORT.

The American Brass Company, Waterbury, Conn., the largest single consumer of copper in the world, closed its second year as an actual operating company with net profits for 1913 of $1,917,605. This compares with $2,274,738 in previous year, a decrease of $357,133, or 15 per cent., but in this connection it is to be stated that the profits for 1912 broke all previous high records with a gain of $829,196, or 36.5 per cent.

Net divisible earnings in the year ended December 31 last were equal to 12.7 per cent. on the $15,000,000 capital stock outstanding and compare with 15.1 per cent. in previous year.

Previous to January 1, 1912, the American Brass Company was a holding company owning the entire stock issues of the Ansonia Brass & Copper Company, the Benedict & Burnham Manufacturing Company, Coe Brass Manufacturing Company and the Waterbury Brass Company, all of which were liquidated and their business taken over by the American Brass Company.

Dividends paid to stockholders have averaged a little over 6 per cent., although 7 per cent. was paid in the past two years.

HOW OLD IS BRONZE?

A Brief Account of the Early Use of Copper Alloys.

By E. F. Gennert.*

In a recent lecture, delivered at the Modern Science Club, Brooklyn, on "Brass and Bronze," one of the audience asked me what the earliest authentic record was of the use of either of these metals. Considering the great many uses of these metals in ancient times, it was difficult to make a positive statement, so I simply referred him to the Holy Bible, Genesis, iv., 22: "And Zillah, she also bare Tubalcain, an instructor of every artificer in brass and iron." This passage differs in several editions. In one, the word "Brass" is used and in others it is "Bronze." I will discuss this difference later. Another question asked me, was, which was older in history, iron or bronze. I thought bronze. This has so often been discussed by scientists, archæologists and others who have given the matter serious study, that I could only recite recorded data:

For instance, we find ancient writers divide the prehistoric antiquities into three successive periods, viz., stone, bronze and iron. They take for granted that among a rude or savage people, stone would come into use before any kind of metal, and that of metal, copper being oftener found ready for the hammer would come into use before iron. These assumptions, which, in-so-far, are only in accordance with what has actually been observed among uncivilized races, have obtained from a very early date. Lucretius, writing in the century before the Christian era, has recorded them with precision (De Rer. Nat. V., 1282):

"The primeval arms were the hands, the nails and the teeth. Together with stones and branches, the fragments of the forests; Afterwards was found the power of iron and of bronze. But the use of bronze was known before that of iron."

The question of priority of these two periods received considerable attention last century. Mr. C. J. Thomsen, of the Ethnographical and Archaelogical Museum of Copenhagen, and Prof. Nilsson, of the Lund University in Sweden, wrote extensively on this subject.

According to their theory, which is held by almost all archæologists in Denmark, Sweden, Norway, Germany and Switzerland and by a few in other parts of Europe, the first three stages from barbarism to civilization are as clearly defined and identified by their relics of stone, of bronze, and of iron, as the comparative antiquity of geological strata or periods of the world's creation is determined by the fossils which they are found to contain. They admit that the periods or classification as adopted by themselves run, more or less, one into another; that stone weapons continued to be used throughout the age of bronze; that bronze and gold were not unknown in the age of stone; and that weapons of stone and bronze continued to be used in the age of irons. This admission obviously detracts very much from the practical value of the classification for chronological or other scientific purposes.

Many British antiquarians have taken objection to the classification altogether, as irreconcilable with generally admitted facts when carried out to its strict and necessary consequences. They point to the everyday discoveries of objects of stone, bronze and iron in the same ancient urns, graves and dwellings. They instance the case of the Huns, who had swords of iron, while they pointed their arrows with bones; the case of the Anglo-Saxons who fought with stone mauls at Hastings; and to the case of the Germans who used stone hammers in the Thirty Years' War. They prove from Greek and Roman writers that the nations of the North and West of Europe used iron weapons during what must have been their bronze age. But although the threefold classification of the Scandinavian and German archæologists cannot be relied upon for historic uses, it has been adopted, for convenience, with some modifications by the leading museums of the world where articles are classed for the most part, according to the materials of which they are made.

Now as regards to the difference between "Brass" and "Bronze." The Phoenicians brought tin from Cornwall 1100 B.C.—before the building of King Solomon's temple. Hiram is said to have made articles of "brass" for the temple (1004 B.C.). This was probably bronze, which is made by the union of copper and tin. Hiram procured his tin from Cornwall, England. Herodotus called Britain "Cassiterides" or Tin Islands. Bronze was obtained by casting, and the implements, it is believed, were tempered or hardened by hammering. The ancient European bronzes which have thus far been analyzed show no trace of zinc, but all contain tin in various proportions, a few also showing lead and lead and iron. The Chinese state that Yu, who was a semi-King with a partner (Chun) on the throne of China, 2200 B.C., caused nine vases to be cast of bronze on which were engraved maps of the nine provinces of the Empire.

In the magazine section of a New York newspaper, Sunday, October 19, 1913, an illustrated article on copper utensils relates the discovery of an ancient copper mine and foundry, just discovered on the Island of Sardinia by the Italian Government. Excavations beneath the ruins of the Church of St. Anastasia revealed a heathen temple dating back 1000 B.C. They found "mounds for casting, just as they were abandoned thousands of years ago as men were making their way upward from stone to the bronze age." Brass was known to the ancients as a more valuable kind of copper. The "brazen bull" was cast by Perillus, of Athens, 570 B.C. It was made hollow to receive victims to be roasted to death. The artist was the first victim and the King who condemned him, Phalaris, of Agrigentum, was forced to try the experiment himself, 549 B. C. The helmet of Psammitichus, the Powerful, was of brass, and from it he poured the libation of the Temple of Vulcan. He was placed on the throne of Egypt, 650 B. C., by the Ionian and Carian freebooters. Brass was known to the Greeks as "Orichalcum" or Mountain-bronze.

*Secretary Manhattan Brass Company, New York.

COATING IRON WITH ALUMINUM

By the process of a Japanese inventor, S. Uyeno, of Tokyo, iron is coated with aluminum by dipping into a bath of the molten metal after being first galvanized. The aluminum bath has a temperature of 600 to 700 degrees centigrade. The temporary zinc or tin surface comes away in the first dipping, but for the best results the article to be coated is treated two or three times. During immersion the surface of the article is swept with a steel brush. The aluminum coating given is claimed to have extraordinary adhesion, so that it will not come off and cannot even be stripped off by mechanical means, and it does not tarnish under the action of air, water or heat.

EDITORIAL

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THE METAL INDUSTRY

With Which are Incorporated
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ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
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CONTENTS

RESEARCH WORK IN METALS

The American Institute of Metals has issued a very interesting report of the work done at the Bureau of Standards, Pittsburgh, Pa., on non-ferrous alloys during 1913. A committee was appointed in 1912 by the Institute of Metals to confer with the Bureau of Standards in reference to the preparation of alloys for standardizing the form and dimensions of standard test bars. A meeting of this committee, consisting of W. M. Corse, J. L. Jones, C. R. Spare, G. H. Clamer, chairman of the Institute Committee, together with P. H. Bates, J. E. Howard and C. P. Karr, representing the bureau, was held at the Pittsburgh laboratories of the Bureau of Standards on March 11, 1913. The work of the committee was carefully discussed and it was agreed to confine the investigation to one alloy at a time. It was also decided that the first alloy worked upon should have the composition: copper, 88; tin, 10, and zinc 2 parts. The following tests were decided upon:

"1st. To determine the best form of test block and test piece, melt a sufficient quantity of the alloy to cast from the same crucible all of the various blocks proposed in the paper of Jesse L. Jones,* also a cast-to-size test bar in green sand and in dry sand in accordance with the recommendations of the S. A. E. Such cast-to-size test bars are not to be machined.

"2nd. After determining the best form of test block and test piece, to cast the alloy at various temperatures to determine the best casting temperature.

"3rd. Make the following tests on all the bars made under No. 1 and 2: Tensile. Elongation. Reduction of area. Stress-strain curve Compression and Micro-structure.

"4th. After conducting the above experiments and finding the proper conditions under which to cast the metal to secure the best results, to cast a sufficient number of test pieces in accordance with such test practice in order to get confirmatory results under the following tests:

Tensile. Elongation. Reduction of area. Stress-strain curve. Heat conductivity. Electrical conductivity. Compression. Coefficient of expansion. Shrinkage. Micro-structure. Tensile properties up to 800 degs. F. Hydraulic. Corrosion: a-ammonia, b-sea-water, c-fresh-water, d-Turtle creek water. Erosion by steam. Sand blast. Hardness. Shearing. Specific gravity. Impact. Fatigue. Thermal Analysis. (Added by G. R. B.)"

C. P. Karr, associate physicist of the bureau, was assigned to the preparation of the alloys. The constituent metals used were electrolytic copper, Banca tin and Horsehead spelter. The general programme called for about one hundred specimens in each of four series of castings.

From the above it will be noted what a vast amount of work is involved in carrying out the investigations planned. In reading over the report, which consists of 29 pages with a 3-page supplement, we are struck with the completeness and thoroughness of detail that Mr.

*The Metal Industry, November, 1912.

Karr has injected into his work. Only three of the series had been completed up to the time of the publishing of the report and that Mr. Karr has profited by the lessons taught in the working out of the three series finished is shown in his remark at the close of his supplemental report. He says:

"In the fourth series, still unfinished, all of the factors affecting the specimens have been reduced to comparative uniformity with the exception of the pouring and danger even from that source has been minimized to some extent by the reservoir of metal provided by the bulb molded with the gate which immediately adjoins each pattern. This fourth series is also in dry sand, poured vertically; in the subsequent series, with the same arrangement of patterns, with equal volumes of metal, poured both flat and vertically in green sand, it is expected that further uniform results will be obtained, and possibly a higher average of results than have been obtained with dry sand molding."

The results given in the report are indicative of the value to the metal founder of the work being pursued by the Bureau of Standards and the American Institute of Metals, and we hope to soon see the completion of the investigations and to learn of the conclusions of the committee. Copies of the report may be obtained from W. M. Corse, secretary of the Institute of Metals.

The Bureau of Standards is engaged in another investigation which will prove as interesting as the standard test bar question. This is the adoption of standard methods of analysis for the determination of the metals most generally used in foundry practice. The bureau now announces, as told in another column of this issue of THE METAL INDUSTRY, that a standard brass sample is ready for distribution. We hope that a number of chemists will send for these samples and lend their aid to the furthering of a meritable work.

CORRESPONDENCE

WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

PREPARED NICKEL SALTS

To the Editor of THE METAL INDUSTRY:

Within the past few years the progress that has been made in the electro-deposition of the different metals has been very marked, especially in the case of nickel. This has been brought about to a large extent by the introduction into this country of a number of prepared nickel salts for which many claims have been made, some of which have been proven correct, while others have not stood the test. I have tried out these different preparations and have given each and every one of them a true and fair test and find that there is only one of them that will do all that is claimed for it. One of the claims made for Prometheus is that it will deposit its metal three times as fast as the regular double nickel sulphate solution, and in the January issue of THE METAL INDUSTRY in an article by Charles H. Proctor the plater is asked if this is a fact. This has been proved to be a fact several times at different places.

One instance of this was a plating room with twenty-one nickel solutions in use, but after the introduction of Prometheus we were able to do all the work in seven tanks with a reduction in the plating room force and a large saving in floor space which we were able to use for other purposes. At the same time the deposit was so much better and softer that a great saving in time in the buffing room and a better finish on the goods was the result.

Another case was on stove work where they were plating the articles for one and one-half hours in the regular nickel bath, but after the Prometheus solution was put in they were able to put the same amount of nickel on in one-half hour and found that they could get a better finish on their goods with less labor on them in the buffing room. At the present time I am doing the work in two solutions of Prometheus that was formerly done in six solutions of the double nickel salts. I have been able to deposit six pennyweight of nickel in twenty minutes on a certain number of pieces with a current of 150 amperes at a pressure of 2⅗ volts from a solution of Prometheus.

Any practical plater can get good results from the Prometheus Nickel Salts if he will take into consideration the high metallic content of these salts and regulate his current accordingly.

THOMAS B. HADDOW,
Foreman Plater, Wm. A. Rogers Company, Ltd.,
Niagara Falls, N. Y.

Formerly with Adolf Neubeck, Buffalo, N. Y., importer of Prometheus Salts.

WONDERFUL FLUX

To the Editor of THE METAL INDUSTRY:

There was recently brought to our attention by a representative of one of the leading foundry supply houses a wonder working bronze flux. He stated that he was selling this flux in large quantities to a certain large valve company. This flux had been granulated by pouring into water and had the following analysis:

Copper	58.85 per cent.
Zinc	30.49 " "
Lead	9.58 " "
Tin	.46 " "
Phosphorus	.64 " "

For this fake he asked the modest sum of sixty cents (60c.) per pound. I am perfectly willing to stand back of my own analysis as a personal matter.

R. T. ROBERTS.

Hastings-on-Hudson, N. Y., January 19, 1914.

BORO-CARBONE VS. CARBORUNDUM

To the Editor of THE METAL INDUSTRY:

I have read the letter of Franklin W. Hobbs in the January issue of THE METAL INDUSTRY. He is pitting his individual experience against my general experience. In conversation with F. L. Degener, of the Keystone Emery Mills, a leading authority on emery, he agrees with me that fully 95 per cent. of all polishers use Turkish emery. Naxos emery from the Isle of Naxos, Greece, is too hard and too sharp. The Naxos grains are so hard and sharp that it does not properly granulate; therefore it is not a desirable polishing medium, except for certain special classes of work. Naxos emery, owing to its large percentage of alumina, follows corundum in the scale of hardness. On certain classes of work Carborundum may be used successfully, but as a general proposition, Turkish emery is best suited because it possesses that peculiar toughness so essential in an economical abrasive. It "breaks down" just right and adheres to the polishing wheel better than Naxos emery, Corundum, Carborundum, Alundum, Boro-Carbone or any other natural or artificial abrasive on the market today.

The above statement is beyond challenge amongst those who understand the situation thoroughly.

WALTER C. GOLD.

Philadelphia, Pa., January 23, 1914.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

BRAZING

Q.—We are having considerable trouble with blow or air holes in parts that we are brazing. They form at the joints of the pieces which are being brazed together.

A.—This is generally due to the fact that you are heating your work to a too high a temperature with the result that the brass begins to boil. Brazing should always be done at as low a temperature as possible and during the operation the molten brass should be continually stirred to remove any air bubbles that may possibly form. In cases where it is impossible to stir the brass satisfactory results can be obtained by proceeding in the usual way, then allowing the work to cool to a dark red and heating it a second time after which it is again allowed to cool. The second heating allows the metal to run into any blow holes which may form, the air being driven out to the surface of the metal. Care has to be taken that the temperature is correct so that it will not boil the second time. In any kind of brazing the best results are obtained by just heating the work enough to allow the brass to melt and flow.—P. W. B. Problem No. 1,924.

BRIGHTENING

Q.—What is the best brightener for a cyanide copper tank? I do both wire and basket work in it. I have been using hyposulphate of soda.

A.—There are a number of so termed brighteners for copper solutions. Bisulphite of soda is used by many platers. This prevents the formation of basic salts upon the anodes and produces a uniform deposit. Sodium sulphate is frequently used instead of the acid salt, but both answer the same purpose. Hyposulphite of soda in which is dissolved a little litharge or acetate of lead finds favor with some platers.

Carbonate of nickel dissolved in a solution of potassium cyanide is also used, but in making additions of the metallic brighteners the material should be added sparingly. Not more than 1 to 2 ounces should be added in a hundred gallon bath at one time.—C. H. P. Problem No. 1,925.

CLEANING

Q.—Can you tell me the cause of my trouble? When I copper-plate polished steel and nickle-plate over the top of that, the nickel strips from the copper.

A.—Your trouble is evidently due to imperfect cleansing rather than your solutions. We suggest that you obtain some crude whitening. This comes in powdered form like pulverized chalk. Mix the whitening to a paste with water, adding a little cyanide to the water. Scour your articles with this mixture, using a regular scouring brush. The material will not scratch on account of being so fine. Afterwards immerse your articles in the copper bath under your regular conditions, and then in the nickel bath, and note the results. This will probably determine whether your cleansing is at fault. If the trouble still continues, then the trouble may be with the copper solution. To overcome this difficulty add two or three ounces of sodium bisulphite to each gallon of solution. This will remedy the peeling of the copper deposit.—C. H. P. Problem No. 1,926.

COLORING

Q.—I have a figure made of statuary bronze, and by cleaning and buffing it became a bright color. What I would like to have is a formula that will produce the statuary bronze color again, and is it necessary to lacquer the figure to retain its color?

A.—To reproduce the statuary bronze color remove the balance of the color in the crevices or back grounds by immersing in a cyanide dip. This consists of cyanide of potassium and water. Four ounces of cyanide to the gallon will answer the purpose. Then wash in water and scratch brush the surface and rewash in cold water.

Now prepare a coloring dip consisting of the following:

Liver of sulphur	½ ounce
Water	1 gallon

Immerse the figure in the dip until a dark brown tone is produced then remove, wash in water and dry thoroughly. Now scratch brush the surface, using a clean, dry scratch brush (soft brass wire gives the best results). This brushing evens up the color and produces the lustre. Afterwards lacquer the figure to protect the finish.

The tone may be varied by immersing longer for dark tones or shorter or more dilute solutions for lighter tones. If you do not succeed in the first operation, the color can be readily removed with the cyanide dip and the operations repeated, providing the copper deposit remains intact.—C. H. P. Problem No. 1,927.

DIPPING

Q.—Please give us a deep black bronze dip for brass ware. A solution of sodium hypo sulphate 8 ounces and acetate of lead 4 ounces, water 1 gallon, is not black enough for our purpose. If we use the arsenic dip, what is the correct method of mixing and are the fumes when boiling poisonous?

A.—For your purpose an arsenic deposit will probably answer better. To produce such a solution dissolve ½ pound sodium hydrate (caustic soda) in 1 gallon of hot water. Then add 1 pound of powdered white arsenic. Prepare as many gallons as required for the purpose and to every gallon of the solution add ½ ounce of cyanide of potassium. Arrange as a plating solution, using sheet iron as anodes. Cleanse the surface of your articles as for plating and in order to get a lustre previously polish the surface and plate for a few seconds or until a good black tone is produced, using a medium strong current of 3 to 4 volts pressure. This solution produces an excellent bright black finish upon articles of silver, copper or brass if previously polished to a lustre before plating.—C. H. P. Problem No. 1,928.

ETCHING

Q.—We are rearranging our tool and bin numbers on our tools used for manufacturing brass goods, and as they are made from tool steel that is tempered and machine steel case hardened, we desire to find out the best formula to use in order to etch the figures and letters on them, as they cannot be restamped.

A.—For etching tool or machine steel a formula composed of the following ingredients may be used:

Nitric acid	60 parts
Copper nitrate	8 "
Muriatic acid	20 "
Water	100 "
Alcohol	120 "

Either paraffin or beeswax may be used for a ground. To apply the paraffin or beeswax shave off with a thin piece of sheet steel, such as an old hack saw, and melt by the aid of a flat iron rod. Be sure that the article is clean and free from foreign substances before etching. Etch with a sharp pointed instrument and apply the solution with an eye dropper. A formula composed of 2 parts of muriatic acid and 1 part nitric acid will also work satisfactorily.—P. W. B. Problem No. 1,929.

FINISHING

Q.—We are experiencing difficulty in obtaining an olive green bronze for brass art metal work. The one we use at present is

produced by dipping the article in copper sulphate and common salt solution. We find, however, that this fails to retain its color on exposure to the light. If you could inform us of any ingredient which would make this color fast, we should be very grateful.

A.—Olive green bronze is being produced by the aid of red ammonium sulphide. It is claimed that this material gives better results than any other material. The proportions used are from 4 to 6 fluid ounces per gallon of water and the solution should be used warm.

Your present difficulty with the mixture of sulphate of copper and common salt is probably due to an excess of salt which produces a chloride of copper. The color of this combination fades on exposure to light due to the chlorine. Lacquering the surface of the articles should protect the color from fading.

The following formula will give a good olive green color:

Water	1	gallon
Sal ammoniac	½	ounce
Cream of tartar	1¼	ounces
Common salt	3	"
Nitrate of copper	1½	"

Problem No. 1,930. —C. H. P.

HARDENING

Q.—In hardening carbon tool steel for dies and general work on brass, what is the best temperature to harden or temper them at.

A.—For the reason that the different grades of tool steel are now made containing various alloys, it is much more difficult to give general rules for hardening and tempering than was the case when strictly straight carbon steel was used for all purposes. The lowest heat should be used so that the steel will properly harden, the lower the better. Most of the carbon steels will harden nicely at from 1,400 to 1,500 degrees Fahr., but too high a heat causes irregular strains and makes the steel brittle. Before attempting to harden a valuable tool experiments should be made by cutting pieces from the end of the bar and heating them at different temperatures so as to learn the lowest heat at which the tool will harden properly.—P. W. B. Problem No. 1,931.

LUBRICATING

Q.—Can you give us a formula for a lubricant for brass faucets and valves, something that will not corrode and that will not dry up and cause the faucets or valves to become set.

A.—A good formula to use is composed of the following ingredients:

Arctic cup grease	25	per cent.
Lard oil	25	"
Beef tallow	10	"
Beeswax	15	"

Melt beeswax on a slow gas stove, when at melting point add beef tallow, Arctic cup grease and lard oil, cook at a slow heat for ten minutes stirring continuously, so that the ingredients become thoroughly mixed. When applying on the plugs or keys of ground key cocks or faucets it is best applied with a small brush, as it spreads over the surface of the key and there is no waste when using. This can be used on thread of valve stems, also as it contains a good body. A good lubricant for thread on valve stems only is plain Arctic cup grease, it spreads well in its natural conidtion.—P. W. B. Problem No. 1,932.

METALLURGICAL

If you can consistently do so, please furnish me with the following information:

(1) What is the best formula for bearings used in locomotive driving boxes?

(2) What is the best remedy to prevent lead sweat in highly leaded formulae cast in sand molds?

(3) What is the cause of porous or spongy spots that appear in the fracture of castings cast in a sand mold when broken and the same does not appear in castings cast in iron molds out of the same heat?

(4) What is the best way to mold and gate castings of this kind?

(5) What is the best flux-covering and blast pressure to use for metal of this kind melted in a No. 3 Schwartz furnace?

(6) If you cannot furnish this information to me personally, can you answer same in shop problems of your paper?

(7) What book would you recommend that would help to solve these problems?

A.—1—Standard phosphor bronze, copper, 80; tin, 10; lead, 10; phosphorus, 1.

2—Add 1 per cent. of nickel to the bronze, using an alloy of tin, 90 per cent., and nickel, 10 per cent.

3—When metal is cast in iron molds, these set the metal quickly, or, in other words, they act like feeders. When it is cast into sand molds it remains fluid a long time and is liable to be made spongy by the gate setting first, or by the gases from the sand.

4—High lead bronzes should be poured with skim gates and very small sprues, as the metal oxidizes readily. The molds should be made from a medium sand, worked as dry as possible. If the sand is too coarse, the metal will sweat into it, and if too close, the castings will blow.

5—A flux composed of 1 part of hard coal, 1 part of fluor spar and 3 of lime is very good. A blast pressure of 20 per cent. should be used.

7—The files of The Metal Industry will be found more satisfactory than any book I can recommend.—J. L. J. Problem No. 1,933.

SILVERING

Q.—We should like to have information regarding a silver preparation suitable for coating the reflecting surfaces on automobile lamp reflectors.

A.—There are a number of silver preparations such as you refer to on the market. These consist largely of chloride of silver, cream of tartar, common salt and whitening. These several ingredients are usually mixed with water to form a paste, and a few drops of strong ammonia applied. The paste is applied to the cleansed brass or copper surface with soft rags, washed with clean water and are then lightly polished with whitening.

The following proportions will produce such a paste:

Chloride of silver	½	oz.
Common salt	1	"
Cream of tartar	2	"
Whitening	8	"

Water Q. S. to make a thorough paste.

The customary method of polishing a silver plated surface such as reflectors is to mix up whitening with a little gasoline, rub briskly with a soft cloth, then let the whitening dry, and polish with a piece of cotton flannel.

To prepare the surface for silvering use any good metal polish, then finish with the whitening. Condensation is usually taken care of by proper ventilation; the heat created should absorb the moisture.

Collodion is used in coating silver surfaces to prevent oxidization; this is in form of a lacquer which may be procured from any of the lacquer manufacturers advertising in The Metal Industry.

Silver deposits give the highest reflective power. Many reflectors are being manufactured from sheet metal. This metal gives a high reflective power when a high polish is maintained. A distant advantage of the use of nickel is that the surface never requires replating.—C. H. P. Problem No. 1,934.

THREADING

Q.—As we have a large quantity of castings to make, the same to have a ¾-inch diameter and 8-inch pitch, acme thread cut on same, also some of them 1-inch diameter with 6-inch pitch acme thread, what in your opinion is the best method of cutting same, using a W. & S. or B. & S. turret machine.

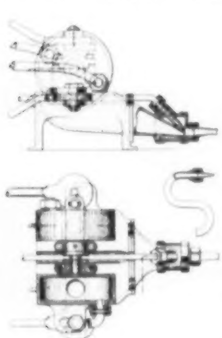
A.—The best method is with a self-opening die head, using two sets of threading dies for the die head, one set for cutting the ¾-inch diameter and the other for cutting 1-inch diameter thread.—P. W. B. Problem No. 1,935.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

1,082,314. December 23, 1913. **Portable Melting Apparatus.** Georg Gabrys, of Budapest, Austria-Hungary. Assignor of forty-five one-hundredths to Frank Yokel and forty-five one-hundredths to Adolf Steffen, both of Meriden, Connecticut.

This invention relates to a readily portable apparatus for the continuous melting of any kind of metals or alloys and for the continuous discharge of the molten metal.



This apparatus has essentially for its object to provide a readily portable apparatus, as shown in cut, capable of melting metals and alloys efficiently, and of supplying the molten metal in a continuous stream.

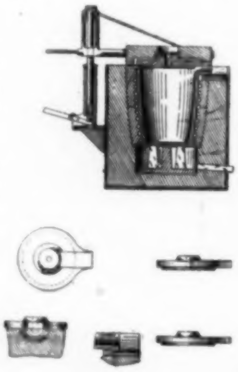
The apparatus is particularly intended for use in processes involving the coating of objects by spraying molten metal thereagainst, but is also adaptable for various other uses.

The melting apparatus embodying the invention comprises a collecting vessel for receiving the molten metal and discharging it ni a continuous stream, upon which collecting vessel a plurality of melting vessels are mounted in the particularly advantageous manner hereinafter described; the construction being such that after a charge of metal has been melted in one of these melting vessels, the latter may be rotated into position to discharge its molten contents into the collecting vessel, such discharge, however, being controlled by a suitable valve with which each such melting vessel is provided. These melting vessels may be heated in any suitable manner, as, for example, by a gas or oil blast-flame.

The Roessler & Hasslacher Chemical Company, of New York have issued a handsome calendar embellished with a photogravure of a Grecian water scene, in the interest of sodium and potassium cyanide which they manufacture at their Perth Amboy, N. J. works. This calendar also contains the latest International atomic weights of the elements, which thus make it a handy reference for the chemist and plater.

1,085,540. January 27, 1914. **Metallurgical-Furnace Part.** W. W. Case, Jr., Denver, Colorado.

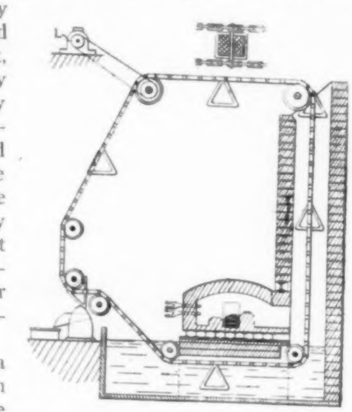
This invention relates to metallurgical furnace parts, and more particularly to a crucible and its mounting in said furnace, as shown in cut, whereby the same may be used as a crucible proper or converted into a retort.



The patent covers: The combination with a metallurgical furnace of a crucible mounted therein and provided at its upper open end with a horizontally disposed curved spout open at its top and outer end, providing a discharge surface substantially below the top edges of the crucible, a lid for said crucible having an annular recess on its underneath face providing a ledge adapted to snugly seat on the top edge of said crucible, said lid being provided with an extending lip or otherwise adapted to cover the upper portion of said spout, a central boss formed on the upper face of said lid, and a removable cover for said furnace provided with a central aperture and a recess on its lower face, for forming a passageway between said furnace cover and crucible lid to conduct the products of combustion through said central opening.

1,085,197. January 27, 1914. **Upright Annealing Furnace.** C. E. Fairbanks, Providence County, Rhode Island.

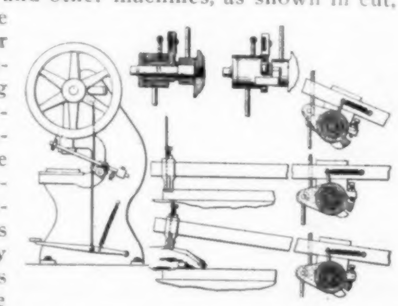
This invention aims to provide an improvement in annealing furnaces especially adapted to the annealing of materials which are subject to injury by oxidation. It is proposed to make the furnace upright, as shown in cut, and to carry the articles through it by means of a continuous carrier. An objection to the old horizontal types of furnace has been the sagging of the carrier and consequent injury to the same. The upright construction also gives considerable economy in floor space and in cost of construction and operation.



It is well known that a number of metals when heated to the temperature necessary to anneal them become oxidized to a greater or less extent. A number of devices have been invented to prevent this oxidation and depending mainly upon either "muffle" furnaces or furnaces sealed at both ends. But in this invention the furnace or furnaces are open at the top and water sealed at the bottom. All of the previous furnaces that are sealed at both ends have been of a horizontal type and to some extent complicated.

1,084,897. January 20, 1914. **Guard for Machinery.** William J. Parkinson, of Rochester, N. Y. Assignor to Pritchard-Stamping Company, of Rochester, N. Y., a corporation of New York.

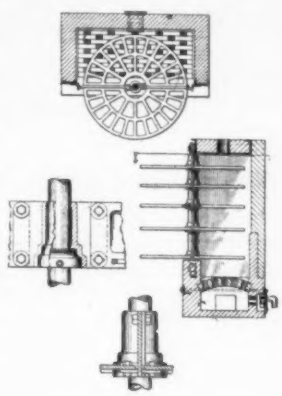
This invention relates to guards, such as are employed in connection with presses and other machines, as shown in cut, to prevent injury to the hand of an operator through accidental contact with the operating instrumentalities or moving parts of such machines. In guards of the kind in question, especially as used in connection with presses, it has been common to employ a guard member which is normally out of operative position, so as to afford unobstructed access to the dies or other instrumentalities of the machine, but which is so connected with the mechanism by which the machine is started and stopped as to be moved into operative position just before, or at the same time that the machine is thrown into operation by means of a treadle or other manually operable member.



The present invention relates to guards of this type, and the object of the invention is to produce a guard of simple construction and reliable operation, and particularly to so arrange the mechanism by which the guard is actuated and the machine is controlled that the guard may be moved fully to operative position before any movement is imparted to the clutch or other device by which the machine is thrown into operation, thus avoiding the danger of operative movement of the machine before the guard has been brought into a position in which it will absolutely prevent the operator's hands from being engaged by the moving parts of the machine.

1,085,153. January 27, 1914. **Core Oven.** A. W. Moyer, New York. Assignor to Rockwell Furnace Company of the same place.

The furnace of the present invention is what is known as a "core oven," as shown in cut, so-called by reason of the fact that it is designed primarily for baking the cores used in foundry work. But while this is its principal use, it will be understood that it may be employed for whatever other purposes may be found practicable.

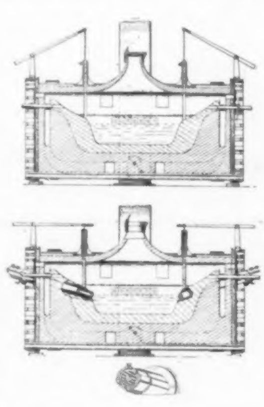


The general objects of the invention are to secure a more uniform baking of the cores than it has been possible to obtain heretofore, to obtain a more efficient regulation of the heat, and to prevent waste through loss of heat.

The inventor claims: In a core oven, the combination of a combustion chamber, a burner discharging into the combustion chamber, a heating chamber above the combustion chamber provided with an opening in one side thereof, an arch between the combustion chamber and heating chamber provided with openings therein to distribute and equalize the heat rising from the combustion chamber into the heating chamber, a supporting shaft mounted in the opening in the heating chamber, independently rotatable trays engaged on the said supporting shaft, closures carried by the said trays, and stops located at the edges of the opening in the heating chamber, said stops and closures having cooperating beveled edges to seal the opening in the heating chamber.

1,084,991. January 20, 1914. **Furnace for Refining Metals.** C. C. Wills, Frederick, Maryland.

This invention relates to improvements in furnaces for refining metals, as shown in the cut, and it consists in the combinations, constructions and arrangements herein described and claimed.



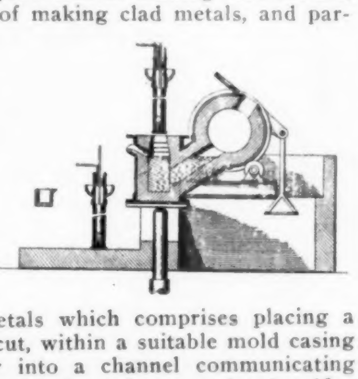
An object of this invention is to provide a device which may be rocked or oscillated so as to cause a movement of the liquid metal, so as to bring the latter in the most advantageous position for air treatment and also causing the dross to be more easily eliminated.

A further object of the invention is to provide a furnace having a plurality of means for heating the metal to be treated, such as gas or the electric arc, in which any of the means or all of them may be used in the refining process.

A further object of the invention is to provide an improved furnace which is so constructed that the heating medium may be treated first in one direction and then in the other, thus insuring the uniform treatment of all the metal.

1,084,474. January 13, 1914. **Process of Making Clad Metals.** W. M. Page, Philadelphia, Pa.

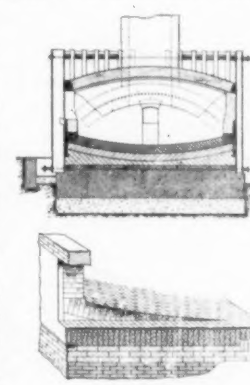
This invention relates to processes of making clad metals, and it comprises a method of making clad metals, and particularly copper clad steel, wherein a billet of metal is first film-coated to secure a weld united coating and is thereafter coated with a substantial body of metal by casting a body of coating metal through a restricted orifice into contact with such filmed surface.



The patent covers: The process of making clad metals which comprises placing a billet of steel, as shown in cut, within a suitable mold casing and casting molten copper into a channel communicating with the interior of said mold through a restricted orifice until a coating is formed, the size of the orifice and the speed of pouring being so correlated that liquid copper remains in said channel above the level of said orifice until the coating is formed, and the temperature of said mold and of said molten metal being so correlated that entering metal first solidifies next the inner wall while later solidifying metal fills up the space between said first solidified metal and said billet.

1,083,719. January 6, 1914. **Metallurgical Furnace.** L. Addicks, Perth Amboy, and C. L. Brower, Chrome, N. J.

This invention relates to furnaces for use chiefly in copper refining. For this purpose reverberatory furnaces are used.

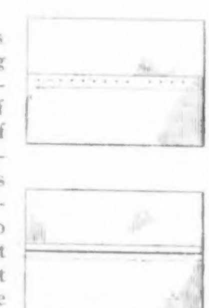


The invention provides a basic-lined furnace for use in copper refining, smelting, or analogous processes. Instead of lining the furnace with silica brick with a dished bottom or hearth of such brick or with a flat bottom of sand, the furnace is constructed with a bottom or hearth of magnesia brick and the side walls and roof of chrome brick.

The patent covers the following claim: A reverberatory furnace having a concave hearth of brick forming an inverted arch and having a side tap-hole, said hearth formed with a transverse channel leading from the middle thereof to said tap-hole, said channel laid of brick which resist the thrust of the opposing half of said arch, and means for resisting the spring of said arch and of said channel beneath the tap-hole.

1,083,956. January 13, 1914. **Electric Seam Welding.** Elihu Thomson, of Swampscott, Massachusetts. Assignor to Thomson Electric Welding Company, of Lynn, Mass., a corporation of Massachusetts.

This invention relates to methods of making seams in sheet metal by electric welding processes.

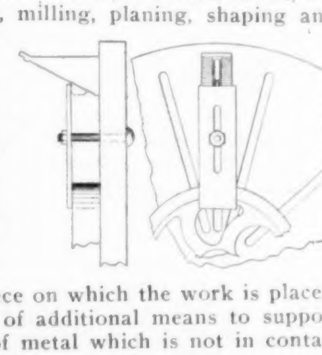


The invention has particular reference to the welding of thin sheets in continuous seams, as shown by cut, by overlapping the sheets or pieces and passing them between rollers which form the terminals of the welding transformer or other source of heating current. If the seam is of considerable length and this rolling process is employed, there is more or less of a tendency to buckle or distort the metal so that a straight seam is somewhat difficult to produce, and the metal will have lost more or less of its flat condition at the seam. This is due to the crowding down of the metal, and its lateral displacement.

The object of the invention is to avoid the failure of making a proper seam due to this warping or buckling.

1,084,352. January 13, 1914. **Work-Holder for Metal Cutting Machines.** Harry Matthews and Herbert Holmes, of Oakworth, near Keighley, England.

This invention relates to work-holders, as shown in cut, for machines for boring, drilling, milling, planing, shaping and slotting metals or the like.



As is well known, in these machines the articles to be treated need to be held in order that the cutting tools may perform their usual and well-known functions. It is also known that the devices usually employed for said holding purposes are strips or bars of metal which are secured by bolts to the base piece on which the work is placed, necessitating the application of additional means to support the end of the bar or strip of metal which is not in contact with the article to be treated.

The present invention consists in the production of an improved adjustable clamp mechanism which will grip the article and retain it firmly and securely.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

DATA ON MELTING FURNACES

By T. E. Daub.*

In answer to a set of questions being sent out in the investigation as to furnaces by the Bureau of Mines, the H. Mueller Manufacturing Company submitted the following:

I.

What is the type of furnace used?

Tilting Pattern, Hawley down-draft furnace, also known as Schwartz melting and refining furnace. Made by the Hawley Down-Draft Furnace Company, of Easton, Pa.

II.

What is the shape and dimension of furnace?

We used the No. 60 inch in making a test of three days; we have in our foundry four 60-inch, one 42-inch, and one 25-inch.

III.

Lining—Material—Thickness.

The 60-inch furnace is lined with fire brick 8 inches thick.

IV.

Cover—Shape and size—Material.

Cover is of iron 16 inches in diameter, lined with 4-inch fire brick lining.

V.

Size of crucible used?

We use No. 35 crucible to pour with only.

VI.

What fuel used?

We use oil.

VII.

(c) Specific gravity 85.
Degrees Beaume 35 degrees.
Density was determined at 78 degrees F.
B. T. U. per gallon—156,024.
Pressure of oil at burner 20 pounds.
Air pressure, 8 ounces.

VIII.

Number of furnaces one tender can handle?

Three furnaces.

IX.

Amount of fuel used per furnace per day?

Our test showed 134½ gallons used per day, of 4 heats per day, and an average of 1 gallon of oil to 49 pounds of metal charged into furnace. Oil was metered by a Worthington Piston ¾-inch meter.

X.

Number of heats per day?

During our test of three days we ran four heats per day, although we often run five heats from a furnace.

XI.

Hours per working day for furnace, i. e., from time cold furnace is started till day is over?

Actual time from lighting of furnace until shut off of blast on last heat was 7½ hours.

XII.

How often are furnaces relined, or other repairs made?

We have to reline these furnaces three times a year, and ordinarily do a little patching up each week to keep them in perfect working condition.

XIII.

How many heats to the life of a crucible?

This is a difficult question to answer. Some of our crucibles only last three or four days, account of breakage, while others last much longer; however, we believe about 450 pots of metal is the average active life of a crucible; we use them for pouring only.

XIV.

Total pounds metal charged in one furnace per day. 6,613 1/3 pounds.

NEW METAL.

Copper	1,681⅓	equals	25.	Plus %
Tin	60	equals	00.9	Plus %
Lead	52	equals	00.8	Plus %
Zinc	208⅓	equals	03.1	Minus %
No. 3 flux	6	equals	00.1	Plus %

OLD METAL.

Gates	1,374¾	equals	20.	Plus %
Sprues	424⅓	equals	06.	Plus %
Borings	2,006⅔	equals	30.	Plus %
Scrap	800	equals	12.	Plus %

XV.

Total pounds metal poured per furnace per day, deducting all losses by oxidation or volatilization, or in the slag or skimmings?

Total charge per day	6,613⅓	pounds.
Total metal poured	6,378	pounds.
Total gross loss	235⅓	pounds.

XVI.

Total pounds metal recovered from slag, skimmings, etc., per furnace per day?

The total recovery is as follows:

(1) 55 pounds of clean metal poured from crucibles at end of test.

(2) 151 pounds of coarse brass taken from the slag by Hill Crusher Dry Process. This is that portion that by gravity drops to the bottom.

(3) 82 pounds of fine brass taken from the slag by the Hill Crusher Dry Process which is obtained through the exhaust which takes the fine residue up to the separator and then separates and returns by gravity.

In use in our foundry items one (1) and two (2) are considered as scrap brass and are weighed back at full weight but item three (3) is sold at $3.60 per cwt., which is ¼ of scrap metal price, hence we will base our figures on the following recovery, as this will show our practice; however, we believe that item three (3) is at least 50 per cent. brass, but we have no equipment for using same.

(4) 21 or approximately ¼ of 82, as in item three (3).

(5) Total 227 net recovery for three-day test.

(6) Total 76 net recovery for one-day test.

(7) Then figuring item three (3) at 50 per cent metal we would receive 247 total, or 82 pounds per day.

(8) Again figuring total returns as best we can do with our equipment we would receive 288 pounds or 96 pounds per day.

But so far as actual values are concerned, No. 6 is the correct result.

XVII.

Gross percentage loss during melting, 3.56 per cent.

XVIII.

Net percentage loss during melting, taking account of metal recovered from all metal bearing refuse?

Actual correct results according to our foundry practice as represented by item six (6), 2.32 per cent.

*Hawley Down Draft Furnace Company, Easton, Pa.

By item seven (7) by placing 50 per cent. on item three (3), our net loss would be 2.23 per cent.

Again by item eight (8), placing full value on item three (3), our net loss would be 2.1 per cent.

We have a small recovery from our roofs. All brass particles lodgings on our roofs are washed down by rain through down spouts into sewer traps, which are periodically cleaned and all brass recovered; however, we have no record as to quantity of this.

XIX.

Average analysis of alloy produced?

Copper	Lead	Tin	Zinc	Unknown
87.25	3.00	3.42	6.43	.02

The above test was made of what we term our number three metal, analysis made by Charles C. Kawin, Chicago, Illinois.

XX.

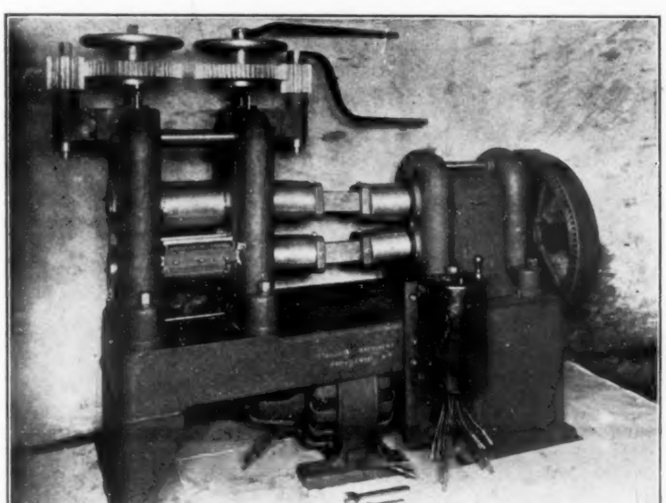
Are your figures based on a single day's run or are they averages; if the latter, on how long a period is the average based?

We made a three days' test and based our figures thereon.

NEW 8-INCH ROLLING MILL

The machine shown in cut is direct connected to type "HF" Westinghouse motor with a special controller and special resistance coils in the circuit which are erected underneath the bed, and cannot be seen in the photograph. The motor is a 20-h. p., 1,150 r. p. m.; it is capable of a 50 per cent. decrease in speed and a corresponding decrease in horse power. This is controlled by the setting of the lever on different notches in the controller. This is said to be an entirely new feature in rolling mill work to control this direct in the electrical circuit, as it allows the operator to start in with heavy stock and vary his speed, as well as the horse power as required.

One of the most important features on this mill is the fact that it is equipped with roller bearings on the roller journals which are claimed to afford a decrease in horse power over a plain bearing mill of from 35 per cent. to 60 per cent. Ordinarily it would be necessary to use fully a 30-h. p. motor on a plain bearing mill of this type.



NEW 8-INCH ROLLING MILL.

The rolls in this machine are made of chrome alloy steel with hardened journals and hardened bodies, the face of the roll being mirror lapped.

The weight of the mill, without the motor is...	10,230 pounds
Diameter of roll journals.....................	5⅜ inches
Length of roll journals.......................	7¾ inches
Gear ratio of mill (exclusive of motor train)...	21½ to 1
Gear ratio of mill with motor................	65½ to 1
Speed of rolls with motor running at 1,150 r. p. m..................................	17½ per min.
Overall length of mill.........................	7 ft. 0 in.
Overall width of mill.........................	4 ft.
Height of mill................................	7 ft.
Height from floor to top of bottom roll, or what is known as working height..............	38½ inches

Further information regarding this mill may be had by corresponding with the manufacturers, the Standard Machinery Company, Providence, R. I.

NEW FOUNDRY RIDDLE

The American Implement Company, of Waterbury, Conn., are showing to the trade for the first time, a photographic reproduction of their new all-steel, truss-stamped rim, patented foundry riddle. In the new "A. I. C." riddle, all of the disadvantages of its familiar wooden-rimmed prototype are claimed to have been wiped out. The new rims are made of one piece of No. 22 gauge steel. A salient point in the design of the rim is the broad hand hold on the bottom edge, a patented feature, and one hitherto unknown in metal rimmed riddles. In combination with this comfortable hand hold is the customary ⅞ inch clearance for the fingers of the operator under the mesh.

ALL-STEEL FOUNDRY RIDDLE.

The construction of the rim is such that the rapping of the riddle on the bench to clean a clogged mesh serves to tighten the mesh, and this feature in combination with the truss-stamping imparts a rigidity that is absolutely devoid of wind, and prevents the sides collapsing even under the heaviest loads that a riddle can be subjected to. Cracked or splintered rims are out of the question, and rivets are replaced by electric welding. The present equipment of the company will produce 1,000 riddles per day. The American Implement Company have several high grade foundry specialties in preparation which will be introduced to the trade during the coming year.

TAMPICO

By Walter C. Gold.*

Tampico or Ixtle is the fibre of the cactus (sometimes called the American Gubear) a wild plant which grows from 12 to 30 inches high on the elevated rocky slopes in the States of Nuero Leon, Coahuilla, San Luis, Potosi and Tamaulipas, all located in the Eastern part of Mexico. It cannot be transplanted. Tampico is cut with a machete and the dressing is done in this country, into which it comes without duty. The amount imported in 1912 was 9,816 tons. But a small portion is used in the manufacture of Tampico wheel brushes; the cordage interests take fully 85 per cent., and the curled hair and kindred lines over 10 per cent. The best grades are sent to England and Germany where, dyed black, it closely resembles black bristle and is used in the manufacture of wearing apparel. In fact it can be so woven as to closely resemble haircloth. The natural color of tampico is a light yellow, but the material can be dyed to any desired shade—gray, black or red, etc.

But it is with wheel brushes for polishing with power that especial reference is made in this paper. Tampico wheel brushes are made principally in two types; the Peerless Farnham brush wheel and the wood block wire-drawn type. The former was

*The firm of Walter C. Gold, Philadelphia, Pa.

invented and patented in 1900 at Honesdale, Pa., and the wheel is built up in sections, the average width of each section being ⅜ inch. The necessary number needed to make a brush of the desired width are put upon a spindle and balanced; and when balanced the wheel is nailed together; then placed upon a revolving trimmer which gives practically a true running face. Since this type of wheel was put upon the market the demand has greatly increased as, for most purposes, it is superior to the old style wire-drawn wood block centre wheel. A decided advantage lies in the fact that by screwing up the metal flanges (and two pairs of different diameters are used) the desired density or stiffness of the wheel may be attained. Through the use of this side pressure the life of the wheel is lengthened fully 50 per cent.; the wheels can also be used to a smaller diameter than the wood block wheels. Every "Peerless" wheel is tested at 2,500 r. p. m. before leaving the factory at Manchester, N. H. They have proven so safe that the writer has yet to learn of the breakage of a single "Peerless" wheel.

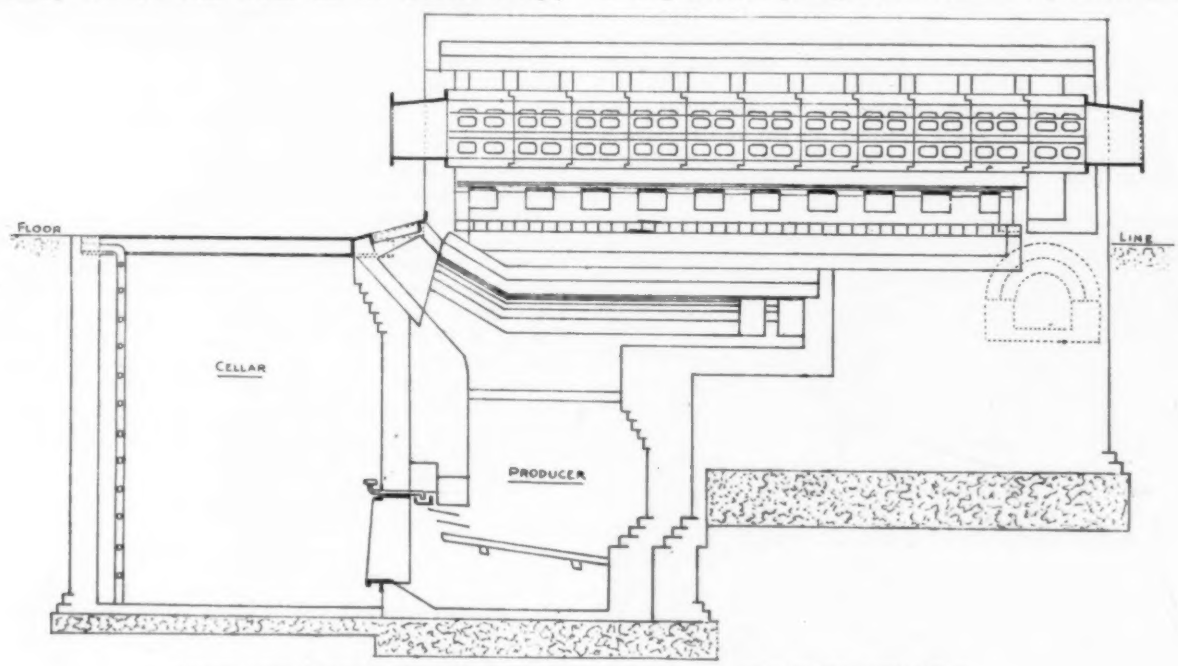
In the wood block type, the wood centre is first turned in a lathe, the proper number of holes drilled and the tampico drawn by means of copper or iron wire. Pitch is then poured into the groove of the block centre on both sides to prevent the tampico from "backing out." It also strengthens the wire and helps hold in the rows of tampico in place. The brush is then placed upon a revolving wheel trimmer, trimmed and is then ready for use.

The tampico wheel brushes of today are certainly a better product than those generally used twenty years ago, and while the consumption has materially increased, the consumer realizes as never before that the *best* wheel brushes are the cheapest in the end—in other words this axiom is again emphasized: "Economy lies in what one gets and not in what one pays."

NEW ANNEALING FURNACE

The Bates and Beard Annealing Furnace Company, Liverpool, England, and H. A. Astlett and Company, New York, have made what is considered an important improvement in their non-oxidizing annealing furnace. As shown in the cut this improvement consists in the substitution of a retort chamber built of segmental fire brick in place of the regular cast iron retort chamber. A gas producer is then employed to get the higher range of heat required.

The gas producer is placed in a pit alongside of the brickwork forming the furnace body, and the stoking holes is on the floor level and can be placed either at the side or at the end of the furnace according to local conditions. The gas producer burns ordinary common coke which can be obtained cheaply



BATES AND BEARD ANNEALING FURNACE WITH GAS PRODUCER ATTACHED.

from local gas works. The producer can also be arranged to burn hard non-bituminous anthracite coal. Of course it will also burn bituminous smoky coal, but we do not recommend this soft coal, because of the liability of sooting up the tortuous gas passages, a small indication of which can be observed on the drawing. By burning hard coal or coke there is no sooty deposit, the flues do not get blocked up and never require cleaning, and the fire clay being practically indestructible, the life of the furnace is very great.

The fuel stands on fire bars made of "V" shaped iron and flat plates. Down these "V" shaped bars water is allowed to trickle, which is turned into steam by the action of cooling the clinker, the steam uniting with the products of combustion of the coke forming a richer water gas. The fire door under the fire bars is always closed whilst working, there being an adjustable shutter on the door which enables just sufficient primary air being let in to support combustion of the fuel. This door, of course, is open wide for the purpose of clinkering, but the fact of water trickling on the fire bars has the tendency of softening the clinker and getting the last ounce of heat units out of it, so that very little absolutely unburnable ash remains and the fire even when working continuously only needs cleaning out once in 24 hours, when the clinker and ash is easily removed, being quite soft and consisting of two or three buckets full only in 24 hours working.

Round the outside of the producer and embedded in the brickwork thereof are secondary air channels, which circulate in long tortuous passages both round the producer and round the combustion chamber, this secondary air finding entrance from the cellar, where the inlets are controlled by a slide damper. The object of these secondary air passages circulating round the producer and combustion chamber is that this secondary air shall absorb as much heat as possible, which would otherwise be radiated through the brickwork, and this radiated heat warms up the secondary air to an extremely high temperature, so that when it is brought to the combustion chamber where it first meets the gases from the producer, the secondary air and the gases are practically at the same temperature, and in this combustion chamber the high temperatures are first obtained.

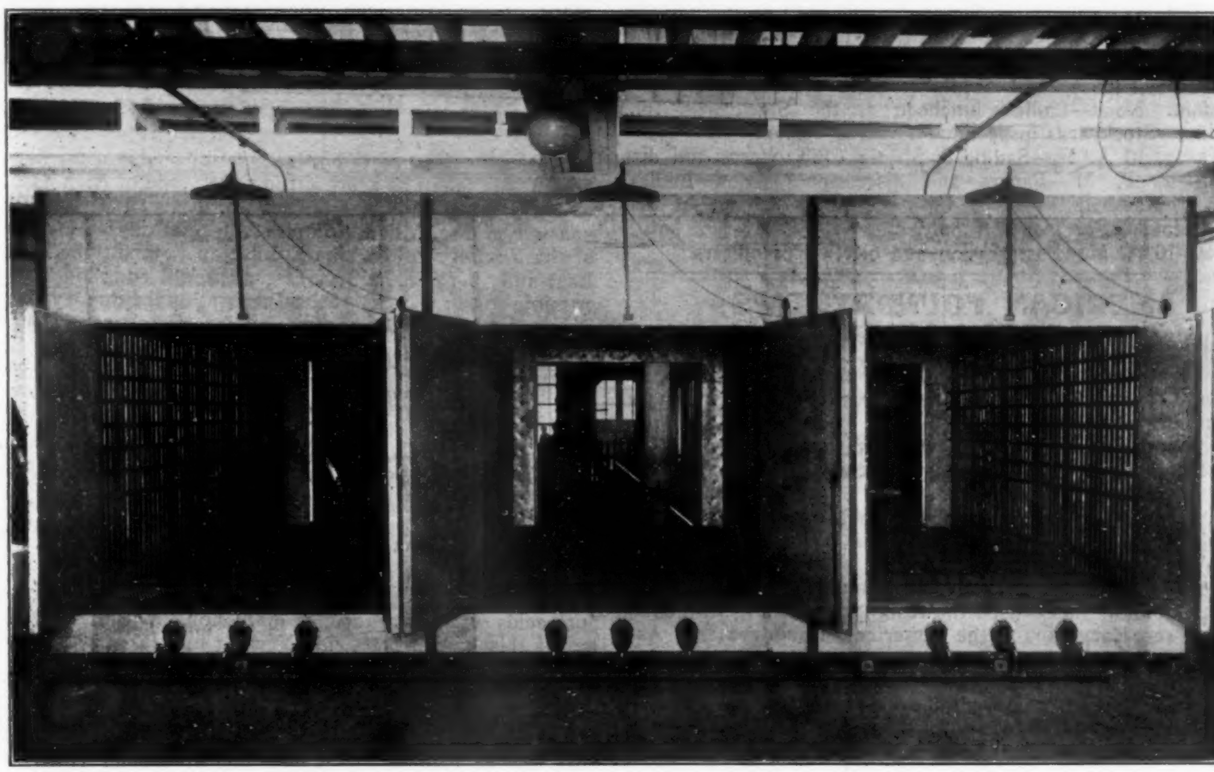
Further information may be obtained by corresponding with John Spalcklaver, of H. A. Astlett and Company, 113 Pearl street, New York.

LARGEST GEHNRICH OVEN

An oven which has been recently installed by Hermann Gehnrich, Brooklyn, N. Y., at the General Fireproofing Company, Youngstown, Ohio, is said to be the largest indirect gas heated oven ever built. This oven, which is 30 feet long, 16 feet deep and 11 feet 6 inches high, is one of the Gehnrich patented radiator type ovens in which the chamber containing the gas burners is entirely independent of the baking compartment, thus preventing any of the gas fumes from entering the baking compartment or the open flame coming in contact with the vapors emitted from the work being baked. This oven is known as a strictly indirect heated oven. The oven is divided into three compartments, each arranged and fitted with burners and thermometers so that each compartment can be run independently and at different temperatures if desired. Each compartment is fitted with doors in front and back to facilitate the handling of the material which is carried in at one side and removed at the other. The oven is being used for baking enamel on metal furniture.

The heating chamber containing the gas burners is built across the entire bottom of the oven and is connected with the ducts at the top of oven by a series of flues or radiators having a total of 55 lineal feet of radiating surface, or a total of 700 square feet in each compartment. On account of the vast amount of radiating surface in the radiator type ovens, the high efficiency is maintained.

In designing this oven it was necessary to give special attention to the supporting of the floor of the oven to carry the load of several tons of material, such as safes, filing cabinets, etc., which are rolled into the oven and baked. The lighter work is placed on bars supported by the side angle iron racks. The entire weight is carried by uprights resting on the ground and run through the heating chamber to the baking compartment. These also act as the fresh air intakes which constantly provides the oven with a supply of preheated fresh air without carrying in any of the gas fumes. The introduction of the air circulates the heat and drives out all the moisture, smoke and fumes, the result being the highest quality of work. The perforated floor plates are supported by castings fastened to the uprights and provide a circulating space above the heating chamber so that it is possible to place the material to be baked on the floor without fear of burning same. A feature of the installation of this oven, which weighed 21 tons, was that the actual installation consumed but 4 days, including the gas connections, and was made by but three men.



LARGEST GEHNRICH GAS-FIRED ENAMELING OVEN EVER BUILT.

COPPER AND SILVER CYANIDE

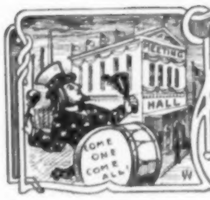
By Carl Dittmar.*

As every plater knows, under certain conditions the metal is drawn from the solution to a greater extent than can be replenished by way of the anodes and results in an excess of free cyanide in the solution. To bring the bath back to standard and overcome this free cyanide, metal must be added to the solution.

It has long been known that the highly concentrated cyanide of silver and cyanide of copper are the ideal replenishing salts, but their use has been somewhat restricted on account of the high cost of the same. The plater will therefore welcome the announcement that copper and silver cyanide are now being manufactured in a commercial way by one of the largest chemical companies so that this material is now sold at a price which compares favorably with the less satisfactory chloride and nitrate of silver and copper carbonate of more or less doubtful purity now on the market.

Cyanide of silver and cyanide of copper are absolutely pure and contain the highest metallic content possible in any salt. Copper cyanide contains 70 per cent. metallic copper and the silver cyanide contains 80.5 per cent. metallic silver, the balance being pure cyanogen. Thus when these salts are dissolved in the cyanide solution no inert salts whatever are formed but a double cyanide of the metal is produced, and a maximum amount of metal is introduced into the solution without the detrimental impurities contained in the metallic salts formerly used. The solution may therefore show a lower specific gravity and still have a higher metal content. Copper cyanide and silver cyanide are practically and theoretically correct and the fact that they are now manufactured and put on the market at a price within reach of every plater will be appreciated by every manufacturer of plated ware.

*Roessler & Hasslacher Chemical Co., New York.



Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

AMERICAN INSTITUTE OF METALS

Secretary Corse states that at a meeting of the committee appointed to arrange for the sessions of the convention to be held in Chicago next September, has settled upon the following provisional programme:

Monday—Registration.

Monday Evening—Foremen's banquet, La Salle Hotel.

Tuesday, 10 A. M.—Joint meeting with the A. F. A. Reports and addresses of welcome. 2 P. M.—Joint meeting A. F. A. Papers. Both meetings on Tuesday to be held at the LaSalle Hotel.

Tuesday Evening—Programme open.

Wednesday, 10 A. M.—Saddle & Sirloin Club, papers and discussion. Noon—Ladies' luncheon at the Stockyards Inn. Afternoon—Stockyards inspection. Evening—Open.

Thursday, 10 A. M.—Saddle & Sirloin Club, papers and discussion. 2. P. M.—Papers and discussion. Noon—Ladies' luncheon, Marshall Field & Co. Evening—Banquet at the LaSalle Hotel. For members only.

Friday, 10 A. M.—Last session and election of officers.

AMERICAN FOUNDRYMEN'S ASSOCIATION

At a regular meeting of the Detroit Foundrymen's Association, held January 8, 1914, the following resolution was unanimously adopted:

Whereas the actions and methods of the Foundry & Machine Exhibition Company have become unbearably aggressive;

And whereas, such actions and methods have become inimical to the life and purpose of the American Foundrymen's Association;

And whereas, the attitude of the Foundry & Machine Exhibition Company has caused the resignation of Dr. Moldenke from the secretaryship of the American Foundrymen's Association;

Be it resolved, that the Detroit Foundrymen's Association are opposed to such actions and methods of the Foundry & Machine Exhibition Company,

And be it further resolved, that it is the sense of the Detroit Foundrymen's Association that all official connection between the American Foundrymen's Association and the Foundry & Machine Exhibition Company be severed;

And resolved further, that the Detroit Foundrymen's Association are opposed to holding the 1914 session of the American Foundrymen's Association in Chicago, Ill.

And be it further resolved, that the president and secretary of this association shall send these resolutions over their signatures, through Jos. J. Wilson, to the meeting of the Executive Board of the American Foundrymen's Association, to be held in Chicago, Ill., January 17, 1914.

The news of Dr. Richard Moldenke's resignation as secretary-treasurer of the American Foundrymen's Association, as noted above, comes as rather a surprise, but in view of the conditions existing between the various associations concerned in the annual convention and exhibition it was to be expected. Dr. Moldenke's value to the American Foundrymen's Association and the great loss that this association will experience in being deprived of his untiring and enthusiastic services, we think, has been admirably referred to in the following expression from *The Iron Age:*

"The resignation of Dr. Richard Moldenke as secretary of the American Foundrymen's Association leaves a void in that organization which is not likely to be filled. For many years to a very large degree Dr. Moldenke has been the organization. When he became secretary he found little more than a loose machinery for bringing a certain number of foundrymen together on an annual junket, with the incidental reading of a few papers on foundry practice. He has built it into a strong organization with over 700 members and producing a literature requiring a stout volume for its proceedings. He has put his talents at the disposal of the membership without stint and has aided in the solution of foundry problems both of individuals and of the industry as a whole to an extent beyond calculation. He has made the association influential at home and throughout the foundry world of Europe. We do not overlook the particulars in which the work of the American Foundrymen's Association must be differentiated from that of the engineering societies, but the very shortcomings of the foundry industry, that for many years made it so little amenable to scientic treatment, add to the credit Dr. Moldenke must have for so greatly advancing it."

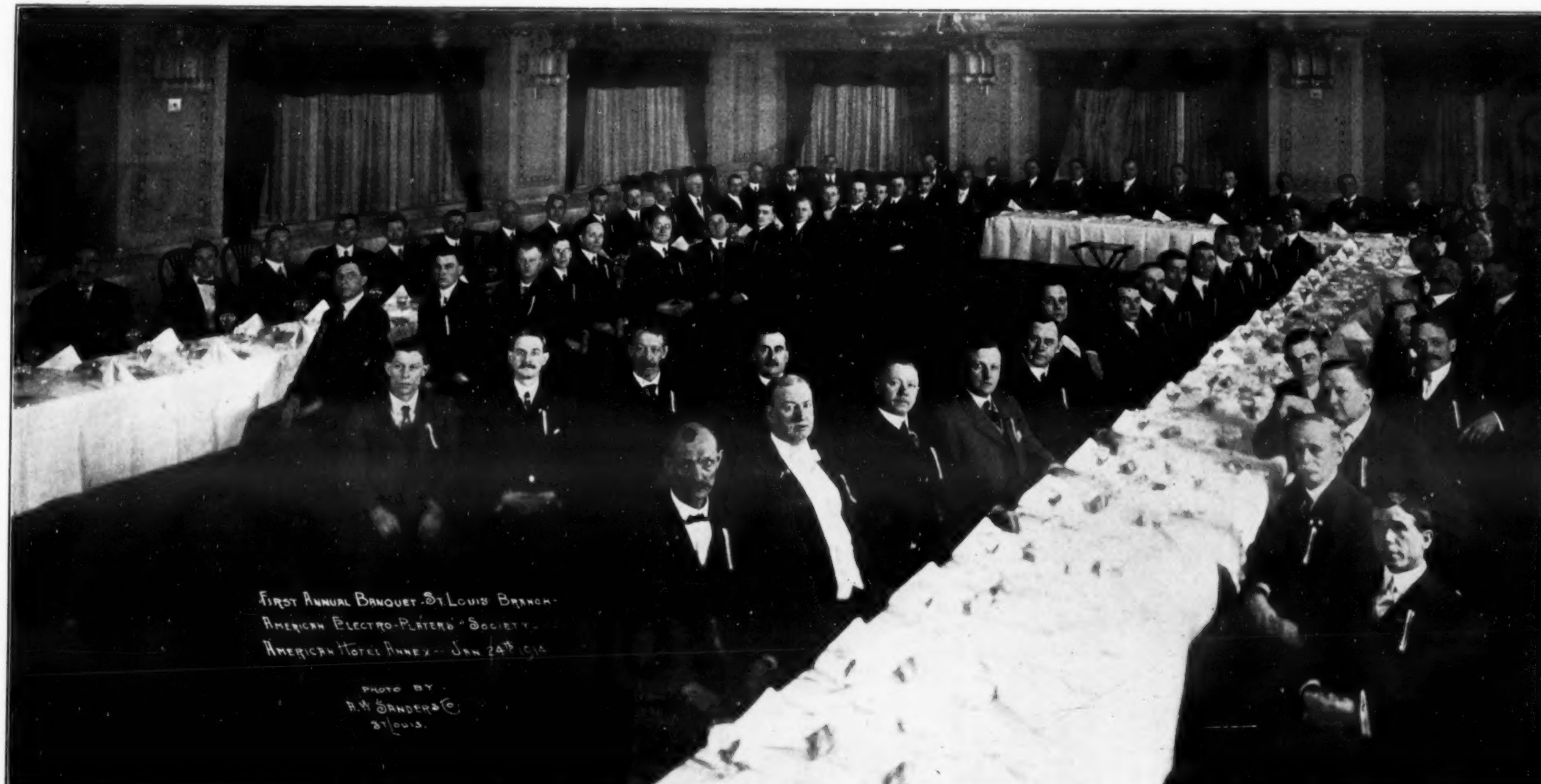
At the meeting of the Joint Committee, January 17, formal action was taken as representing the voice of each association to the effect that it was the plan and wish that the 1915 convention of the Allied Foundry Associations and the exhibit of the Foundry & Machine Exhibition Company be held in the East and at a time and place that would contribute as far as possible to the success of the International Foundry Congress. Plans for the 1914 convention program were tentatively discussed.

AMERICAN ELECTRO-PLATERS' SOCIETY

The regular meeting of the New York branch was held at their rooms, 309 West 23rd street, January 23. Twenty-five members were present, and the evening was spent in discussing ways and means of producing the various green bronzes, japanese bronzes, gun metal finishes and rust-proofing of iron and steel to withstand salt water. The difficulty of bright dipping in impure acids was also a topic of discussion. The banquet committee of this branch met with Newark branch to perfect the arrangements for the annual banquet.

The banquet committee representing the New York and Newark branches of the American Electro Platers' Society, report through its chairman, W. J. Schneider, that the annual banquet will be held in the Marlborough-Blenheim Hotel, Broadway and Thirty-sixth street, New York, on February 21, at 8 P. M. The committee particularly invites platers to exhibit samples of their work, including deposits and finishes. While the arrangements for the banquets are not fully completed, Mr. Schneider is sure that some prominent men will be engaged as speakers and that the banquet will be a very enjoyable occasion. Tickets may be obtained at $1.50 each from C. O. Fields, secretary of the banquet committee, 30 Cortland street, Newark, N. J.

The Detroit branch held an open meeting and smoker on January 17 at the Manufacturers' Association Hall. Mr. Barrows, of the Toronto (Canada branch, explained to the manufacturers and school board present how the Toronto branch obtained the use of the laboratory of the Toronto Technical School. Mr. Barrows was followed by a short talk given by F. B. Stevens on education, and who set forth the value of the Detroit branch obtaining the use of the laboratory of the Case Technical School. Mr. Sherman and Mr. Maynard, of the school board, gave a few remarks and also asked that a committee be appointed to meet Professor Chadsey, superintendent of the schools, and which was done the following Monday night, January 19. Mr. Moore and Mr. Childs, instructors in chemistry at the Case Technical School, stated that they would do all they can for the Detroit branch, and as soon as the annex of the school was finished would take the matter up further.



BANQUET OF ST. LOUIS BRANCH OF THE AMERICAN ELECTRO-PLATERS' SOCIETY HELD AT AMERICAN HOTEL ANNEX, ST. LOUIS, MO., JANUARY 24, 1914.

St. Louis branch, A. E. S., held their first banquet at the American Annex on Saturday, January 24, with eighty-one members and their employers present, it being one of the objects to enlighten the manufacturers on the real work and show them that the benefits received are mutual.

The hustling ability of E. J. Musick, chairman of committee, was shown by the attendance, and after an excellent dinner served in the magnificent banquet room of this new hotel, he introduced H. H. Williams, secretary and treasurer of St. Louis branch, as toastmaster. Mr. Williams in a few words extended a welcome to all, and stated a few facts concerning St. Louis branch, as follows: That on December 5, 1912, it started with nine members and a month later, with nineteen members, applied for a charter, and at present has twenty-six members in good standing. He also told of the work it was doing and the results.

E. Lamoureux, of Chicago branch, was introduced as the father of the branch, he having been instrumental in starting it off. Mr. Lamoureux read a paper on "Efficiency: Technical and Business Ideas on Electro-Plating." "The Past, Present and Future of Electro-Plating" was the subject of a paper read by H. J. Richards, of St. Louis branch. Mr. Richards had a good story to illustrate every point. "The American Electro-Platers' Society" was the subject of an address by our Supreme Vice-president, J. H. Hansjosten, of Kokomo, Ind., and special mention was made of this excellent and able address.

F. J. Liscomb, of Chicago, read a paper on "Nickle Solution Investigations," which was the result of experiments as to metallic content and other conditions.

One of the pleasant surprises on this occasion was to have present with us the founder of the society, C. H. Proctor (who also represented our Supreme President, George B. Hogaboom). In his adress Mr. Proctor congratulated our branch; told of the societies' activities and predicted a bright future for all. Oscar E. Servis, secretary and treasurer of Chicago branch, brought greetings from his branch, and made an address on "Mysteries of the Past and Co-operation of the Present." Impromptu remarks were made by the following manufacturers: C. Phillips, of Landay Stove and Range Company; F. R. Henry, Majestic Manufacturing Company; W. F. Koken, Koken Barber Supply Company; W. H. Musick, Musick's Plating Works, also by H. H. Van Horn, H. C. Starrett, of Chicago; O. Halmbacher, of Decatur, Ill.; G. Hamman, of Quick Meal Stove Company, and H. C. Horner, of Bridge and Beach Manufacturing Company.

The following committee were in charge: E. J. Musick, J. T. McCarthy, H. J. Richards, R. O. Bosch and H. H. Williams.

ASSOCIATED FOUNDRY FOREMEN

A meeting between David McLain, of McLain's System of Milwaukee, Wis., and President Blair and Secretary Thomson of the Associated Foundry Foremen, was held in Chicago, Ill., January 17, when Mr. McLain donated a course of his system to the association. As it is the intention of the officers to build up the association this year they have decided to give the course as a prize to the member obtaining the most new members to join the association between the 1st of February and the 1st of September, 1914. In case the winner of the prize should be a graduate of the McLain's System school, Mr. McLain will give him the money instead. Any foundry foreman can procure information from the secretary, Robert B. Thomson, 78 Verplanck street, Buffalo, N. Y.

The Chicago foundrymen met at the La Salle Hotel on January 12, and perfected a temporary local organization, with Charles B. Carter as chairman, and O. J. Abell as secretary.

ITEMS OF INTEREST TO THE INDIVIDUAL.

H. C. Barnard has accepted a position as foreman plater with the City Button Works, New York, N. Y.

H. D. Gates, who has been secretary and sales manager of the Pangborn Company since 1909, has relinquished that position in order to join the sand-blast department of the De La Vergne Machine Company, New York, N. Y.

Foster J. Hull, engineer of the Pangborn Corporation, Hagerstown, Md., has severed his connection with that company and is now associated with the De La Vergne Machine Company, Mott sand blast department, New York, N. Y.

N. B. Ippolito, for the past twelve years foreman of the plating and buffing departments of the Pittsburg Lamp, Brass and Glass Company, N. S. Pittsburgh, Pa., resigned his position February 1. Mr. Ippolito's present address is 642 Parkview avenue, Avalon, Pa.

Charles J. Caley, general superintendent, Canadian Yale & Towne, Ltd., St. Catharines, Ont., Can., has resigned his position, to take effect March 1. Mr. Caley states he has no definite plans for the future. His address after March 1 will be 65 Olive Street, New Haven, Conn.

Professor H. C. H. Carpenter, who has lately been appointed professor of metallurgy in the Royal School of Mines of the Imperial College of Science and Technology, London, England, is now in this country for the purpose of familiarizing himself with the United States methods of copper smelting. Professor Carpenter in an interview at the Hotel Imperial in New York said that "The history of copper in the last hundred years has shown a curious shifting in the centre of the industry from one part of the world to another.". He said, "at the end of the eighteenth century Great Britain produced about 75 per cent. of the world's output of copper. Today finds North America turning out 70 per cent. of the enormously increased product." Professor Carpenter's intention is to spend six months in the United States and Canada making a close study of what is going on in the copper and other metal industries. He will visit Tennessee, Utah, Arizona, Nevada, Colorado, Washington, Vancouver, B. C.; Montana, Michigan and Sudbury, Cobalt and Porcupine, in Canada.

DEATHS

John C. Kelly, founder, and for the past 44 years president of the National Meter Company, Brooklyn, N. Y., died at his home in that city on January 24.

Frank X. Brabant, president, Michigan Brass & Foundry Company, Detroit, Mich., died January 23 after an illness of several weeks, aged 54 years. Born in New York, he located in Detroit 20 years ago and soon entered the brass business as secretary and treasurer of the Standard Brass & Mfg. Company, later going to the Michigan company as its head. He leaves a widow.

W. J. WILDER

W. J. Wilder, 66 years old, inventor and president of the Wilder Metal Coating Company, South Connellsville, Pa., died at his home January 14. Mr. Wilder was born in Germany on December 15, 1848, and he came to this country when he was five years old, spending most of his boyhood days in Boston, Mass. In 1900 he went to Connellsville and organized the Steel and Iron Aluminum Company, and in 1908 the Wilder Metal Coating Company, at South Connellsville, was formed, of which he became president, holding that position until his death. Mr. Wilder was one of the first electro-platers in this country and invented a number of electro-plating processes. As early as 1872 he was awarded a diploma at Cleveland, Ohio, for the best galvanic battery produced at that time. He did the first electro-plating on Pullman sleeping cars, and followed this occupation for a number of years in New York City.

W. J. WILDER.

ERWIN STARR SPERRY

Erwin Starr Sperry, editor and publisher of The Brass World, died at his residence, 1417 Fairfield avenue, Bridgeport, Conn., on Saturday, January 31, of Bright's disease. Mr. Sperry was born in Ansonia, Conn., on February 28, 1866, and was the son of Hobart and Mary French Sperry. He received his early education at the Ansonia and Derby High Schools, graduating from the latter in 1884. Later he attended the Sheffield Scientific School of Yale University, New Haven, Conn., from which he graduated in 1887, and immediately afterwards accepted a position of assistant instructor in chemistry.

Early in 1891 he went to Bridgeport, Conn., as the chemist for the Aluminum Brass and Bronze Company, and afterwards was superintendent of the Waldo Foundry. He was a very able writer on metallurgical subjects, having specialized on the non-ferrous metals, particularly on the subject of brass and its manufacture. At the time of the establishment of the Aluminum World in 1894 he wrote a series of articles on aluminum alloys and kindred subjects, and continued as a writer for that journal up to the time that the Aluminum World was merged into THE METAL INDUSTRY in January, 1903. From January, 1903, to October, 1904, Mr. Sperry was editor of THE METAL INDUSTRY. Nine years ago he started publishing The Brass World at Bridgeport, Conn. Mr. Sperry was a member of the leading metallurgical societies of this country and Europe. Besides his wife, he leaves a sister and a brother.

Trade News

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS AND TRADE ITEMS OF INTEREST FROM THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

BRIDGEPORT, CONN.

February 2, 1914.

In reviewing the present conditions in this city and the outlook for the coming months there seems to be no doubt in the minds of most of the leading metal men that there was an improvement last month over the preceding quarter in most lines, but there is still chance for better conditions. A feeling of optimism prevails, however, that business will continue to improve, although it must necessarily be slow after the decided reaction of the fall. Generally speaking, activities are still only fair, in some lines poor, and the open winter has tended to decrease demands, although it has meant a big saving to hundreds out of work.

On being interviewed as to the condition of their business a representative of one of the largest brass rolling mills, producing sheet brass, tubing, rods, etc., stated that it was fair, but that the outlook was better. It was conceded that spring would bring increased trade, especially in the manufacturing end, producing electrical supplies, etc., needed for building operations.

The same may be said of the silver plating concerns which supply work for many people of this city. The slump after Christmas still continues, but this is not their busy season anyhow. The opinion seems to be, however, that there cannot but be a decided revival soon.

The automobile trade seems to be brisker since the motor car show, which was conceded to be the best ever held here. Sales were good and there was much interest displayed in the new models, particularly the small, cheap cars, one of which is being turned out by a local manufacturer. The largest builder in the city has just started in full time after a quiet period, with some departments, such as the body and pattern makers, working overtime. The placing of their contracts for castings and part supplies has helped business materially among the local foundries and factories.

Makers of brass and bronze castings report times rather quiet, although the monumental work continues normally about the same. The aluminum foundries are still somewhat slack and the United Foundry & Machine Company have been forced into the hands of a receiver. Due to the competition with the Western foundries they have found it hard sledding and President Steen was appointed temporary receiver. They employ about one hundred hands when busy, but whether they will continue in operation will be decided later.

The manufacturers of brass and bronze pipe fittings, castings, etc., are still feeling the effects of the depression and the hardware manufacturers also continue quiet. "It ought to pick up very shortly though," is the expression heard most. Electrical supply people are experiencing a quiet period and the manufacturers of machines, machine tools, etc., are in about the same position, playing rather a waiting attitude. It is understood though that the latter expect soon to place their products on the market with renewed vigor. The graphaphone business has been very good until lately, when a number of men were laid off, but this is expected at this time of the year. Typewriter concerns are also in a passive state. One of the local builders of motors for motor boats has just completed a contract for a New Jersey firm making launches.

Building has been very much reduced, due to the tightness of the money market in a measure and this has worked its hardship on the electrical and hardware supply houses. The demand for wire cloth, screens, etc., has also been light and the manufacturers have been working on stock. At the present writing orders are beginning to come in faster.

Of interest to the local trade is the announcement that a tractor invented by Henry J. Stegemen, of the Locomobile Company, is to be backed by the Automatic Machine Company and will enter the field in competition with other tractors. At present it is being exhibited at the Fruit Growers' Association at Rochester, N. Y. It is said to be particularly adaptable to New England farming work and combines many novel and ingenious features. It can be operated by one man and is simple in design, having only two wheels which are traction wheels. It is gasoline propelled.—F. H. C.

NEW BRITAIN, CONN.

February 2, 1914.

Troublesome clouds are beginning to disappear and the metal industry horizon in New Britain is again assuming a somewhat more rosy tint. During the past month local stocks on every hand have picked up considerably, advances from three to ten points being noted and six point gains being a fair average, and but little of the New Britain hardware stocks are to be found on the market. This is taken as a most favorable sign by local manufacturers and they all report a larger number of heavy orders coming in, which accounts for the present boost. Work is also picking up and the various factories have ceased to lay off employees for lack of orders. Thus, from the statements of the leading men in the manufacturing field of this city, it is evident that 1914 will be at least fairly prosperous and the long feared slump is beginning to be disregarded by the wise ones. One prominent leader in manufacturing circles stated emphatically to a representative of The Metal Industry that his business, as well as that of others, has shown a marked increase since November and December, and he thinks that the coming months will be even better.

President Henry C. M. Thomson, the former New York man who is now at the head of the American Hardware corporation, told a Metal Industry correspondent that he does not expect the forty-five-hour schedule now being observed will last more than a couple of months. "I doubt if it lasts that long. We will be glad to change back as soon as conditions warrant the return to the old schedule. Of course this is only precautionary on our part," said the president.

New Britain's industrial growth will be given further impetus as soon as the new building being erected by the Corbin Screw Corporation on High street is completed, as it is the purpose of the officials to move the Universal Screw Company, of Hartford, to this city to occupy the new structure. This Hartford concern was purchased some time ago by the Screw corporation and will be a welcome addition to New Britain's manufactories. About 100 skilled hands are employed in the works of the Universal company and it is expected that many of those will remove to this city when the change of location is made. It is expected that the construction work on the new buildings will be complete in a couple of weeks.

An innovation, which, while it does not affect the manufacturing conditions, will doubtless prove of interest to readers of the publication, has been started by Landers, Frary & Clark, large cutlery workers and makers of the famous universal kitchen utensils. On January 30 notices were posted in the factory to the effect that any employees who deal with installment or credit houses will be instantly discharged. This has been brought about by the officials being pestered by creditors who want their weekly installments taken from the employees' pay.

William F. Troy has resigned his position as assistant to the superintendent of the Corbin Screw Corporation, George P. Spear. Another interesting event amongst the manufacturers is the sending out of five junior salesmen by the Stanley Works. Since October this concern has been conducting a school in salesmanship and the graduates have been placed about the country and seem to be making good.—H. R. J.

PROVIDENCE, R. I.

February 2, 1914.

There was a decided falling off in the various metal industries of this city and vicinity during the first month of 1914 as compared with the corresponding month of 1913. The foundries report about the same volume of work as has been doing for the last few months and there are about the same number of employees engaged in the various lines. There is a very optimistic feeling, however, and it is claimed that the outlook is fairly good and that with the arrival of spring weather there will be as much activity as a year ago.

Business has been unusually quiet among the manufacturing jewelers, a majority of the factories running on short time, while few orders are being booked. Those that are coming in are small in quantity and for immediate delivery. Many of the manufacturers have their representatives on the road, and while none are receiving large orders, they continue to take a cheerful view of the situation and hope for an improvement in a short time.

The Gorham Manufacturing Company closed its extensive plant at Elmwood the last two weeks in January, remaining shut down for two weeks. This is the first two weeks' idleness experienced in several years. The company, however, has several good sized orders on hand, especially in the bronze department, and reports are very encouraging.

The United Wire & Supply Company, which conducts a plant on Summer street, this city, for the manufacture of wire, tubing and other findings for jewelers' use, and another in Pawtucket, where metal supplies for automobiles are manufactured, is considering the combining of the two plants at Cranston, where a large tract of land with several large buildings has been secured under option. The company is to petition the City Council of Cranston for an exemption from taxes for a period of ten years and if this is granted the new plant will be occupied. This has become necessary because of the rapid increase in both lines of business, and concentration is desired so as to facilitate business.

Fire in the plant of the Healey Enamel Company on Washington avenue, Cranston, recently did damage to the extent of several hundred dollars. The fire was caused by the boiling over of a mass of enamel.

Fire in the Manufacturers' building, on Aborn, Sabin, Beverly and Mason streets, recently caused a loss of about $175,000, the manufacturing jewelry plants of Martin-Copeland Company, the Bassett Jewelry Company and Lyons Manufacturing Company being the heaviest losers from fire, although upwards of a dozen other concerns were damaged by smoke and water.

Walter S. Hough, president and treasurer of the manufacturing jewelry concern of Wightman & Hough Company, died January 29 in his eighty-sixth year. He was probably the oldest manufacturing jeweler in active service in the country, as he practically continued at his office until within a few weeks of his death. He had been connected with the industry as apprentice, journeyman and manufacturer since he was 17 years of age. He leaves two sons, who are identified with the industry.

BOSTON, MASS.

February 2, 1914.

Conditions show little change in the metal industry in this city at the close of the first month of the year by comparison with those prevailing when 1914 arrived. In a general summary of the situation manufacturers state that the trade is quiet, and the outlook, although affected by a more widespread hopefulness that has developed in industrial circles, is not less conservatively watched than it has been for some time past.

This means that no experiments will be tried for the present and that there is to be no deviation from the policy of making goods to fill actual requirements, rather than in anticipation of future needs. In other words, there is little incentive to make goods ahead for stock, and little inclination to be venturesome in any branch of the metal industries.

Jewelry repairers have been quiet all along the line since the holidays. One of the biggest concerns in this trade has been obliged to ask for an extension of credit, so light has its business become in the past two months. Others admit that they would welcome about twice as much work as they are obtaining, and would have little difficulty in attending to it without increasing their working force very much.

It is still a recognized condition in the trade that workmen who drop out from any cause are not replaced, and occasionally there are dismissals of the less valuable men and of latest additions to the crew of workers.

Yet the quiet is not universal. Occasionally in a tour of the shops an employer is found who declares that he cannot complain, but is as busy as he cares to be. One of the noticeable features, however, is an indisposition to be quoted individually on the subject. Few manufacturers or jobbers in metal products like to be responsible for the statement that the outlook is other than satisfactory.

It is emphatically a time of waiting for developments in this section, but all concerned are evidently trying to be optimistic, and the consensus of opinion appears to be that the year as a whole may work out favorably and measure up to normal proportions in its output, even if it does not surpass the production of the previous year.—J. S. B.

BURLINGTON, VT.

February 2, 1914.

There is usually every year a general slacking up in the metal trades in Vermont at this season, but the outlook for the future is as good as any section of the country, judged from reports made in The Metal Industry. There is not a great number of manufacturers of metal goods in Vermont, but the metal shops located here are well established, and there is always a steady demand for the goods manufactured.

The Fairbanks Scale Company, of St. Johnsbury, said to be the largest scale shop in the world, reports a very good year's business for 1913, and does not expect any marked decrease in business for 1914. This company was established in 1830, and its business interest reaches out to every state in the Union, as well as to most foreign countries. It is therefore a good barometer of business conditions. It has not felt any greater fluctuation in business than is usual at this time of year. It is also reported the Howe Scale Company, of Rutland, has done a larger business during 1913 than in any previous year, but this is not official. The Howe Company does not expect to run on reduced time and all metal shops in Rutland are reported to be busy.

The L. F. Benton Company, of Vergennes, manufacturers of the Benton spark plug for automobiles, are very busy. The spark plug manufactured by this concern is said to be the best on the market, and many thousand are sold throughout the country.

The National Automatic Machine Company, recently moved to Brattleboro from New York City, is doing a good business. This company manufactures a machine for sealing envelopes and affixing stamps. It is a high-grade product, and very useful to every company handling a large quantity of mail.

The Backus Heater Company, of Brandon, organized about a year ago, reports business increasing steadily. This company manufactures the well known Backus steam and gas radiator and fire place fixtures. The Vermont Farm Machine Company, of Bellows Falls, manufacturers of cream separators, are running with a slightly reduced force, but no marked decrease in business is expected by this company.

The general slowing down in industrial enterprises, felt throughout the country, is reflected in conditions in some sections of Vermont and New Hampshire. The foundries in Springfield, Vermont, at this writing are running four days per week, and semi-official reports state that the working time may be cut down to three days. On the other hand, the general impression is that this condition is only temporary, and that full time will be resumed shortly. Springfield is the metal trades center of Vermont, several large metal factories being located here. The well known firms of Jones & Lampson, The Springfield Brass Company and Parks & Woolson are located in Springfield.

The Sullivan Machine Co., of Claremont, N. H., a short distance from Springfield, has to the present time been running full time. It is stated, however, that the working days will be reduced to 5½. This company manufactures mine

machinery and normally employs six or seven hundred hands. The Vermont Construction Company and the machinery shops in Burlington and vicinity seem to be as busy as usual at this time of the year. The Burlington Mirror & Plating Company have recently increased their equipment and in addition to manufacturing mirrors do most of the job plating in this section of the country.—E. B.

NEWARK, N. J.

February 2, 1914.

John Williams, Inc., of 56 West Twenty-seventh street, New York City, made the bronze castings for a tablet, commemorative of the battleship Maine, which is being distributed to municipalities and historical societies all over the country, by their paying the cost of manufacturing. The tablet weighs twelve pounds, is 13 x 18 inches in size. Charles Kick is the designer. This tablet was described in The Metal Industry, May, 1913.

The Flanigan-Weinbrecht Company started in business at 20 Columbia street, repairing jewelry, plating, coloring, stone setting, etc. It is reported Shaw Bros., of Monroe street, have opened a brass foundry.

The Orford Copper Company at Bayonne transferred their plant to the International Nickel Company. The plant is worth fully two million dollars or more. The works consist of a number of factory buildings and have a good frontage on the Kill von Kull.

George Hills, who was for years manager of the welding department of the Garwood (N. J.) Electric Company and the C. & C. Electric & Manufacturing Company, is now with the Electric Welding Material Company, 7149 Broadway, New York City.

The Howard Miniature Lamp Company, of 395 Bank street, have erected a new building at Springdale avenue and Nineteenth street.

Charles H. Green, of Ridgewood, N. J., who during the past ten years has been connected with forty industrial expositions and trade shows, expects to put in a busy years as chief of the department of manufactures and varied industries at the Panama-Pacific Exposition. This exposition opens in a year and New Jersey will be well represented. The New Jersey state commission, backed by the Board of Trade of Newark and other bodies, expect to install complete exhibits showing the manufacture of jewelry, silverware, the metal lines, platinum, machinery, tools, supplies, etc., of every description. The San Diego exposition, which will start January first next and continue a whole year, will also be patronized. The Orange Manufacturing Company, of Emmett street, making brass goods, expects to erect a new building.

Baker and Company have erected a three-story and basement addition to their big factory, which is 180 x 50 feet in size. They do a large smelting and refining business. The new building will be used for manufacture of platinum settings, sheet rolling, metal working, laboratory and chemical work. The setting department has been tripled in size and considerable more machinery added.

T. D. Mayfield, of the Richardson building, is using what he claims is a new metal, "bonite," which he says is a superior casting metal.

George McAleer started in two years ago buying out Felix Vincon, colorer, at 355 Mulberry street. He has since added a polishing and plating plant.

Schliss, Brod & Company, since the consolidation of the two firms two years ago, have built up a large business and expect to enlarge by taking the entire building at 30 Beecher street. They sell to the jobbing trade and have been featuring enameled gold emblems.

The Marx-Winkler Company are pushing their patent dust collector for the jewelry factories.

R. Kurschenkel & Son have a better place of business, doing engraving and chasing, at 351 Halsey street.

B. Coulan & Company, manufacturing metal novelties, built an addition to their factory in Hamilton street.

Robert J. Metzler and Theodore Friedeberg have been pushing the New Jersey Machinery Exchange at 349 Market street, selling largely to the manufacturers of jewelry, silverware and metal lines.—H. S.

PHILADELPHIA, PA.

February 2, 1914.

The metal trade in this city and section has gradually been increasing in volume during the past few weeks and many firms report increased business. Samuel W. Brown, Jr., of the Hungerford Brass and Copper Company, says that although the number of sales has not decreased they are considerably smaller than last year, and there is just a tremor of uncertainty prevalent throughout the trade.

A more cheerful atmosphere has settled over the manufacturing jewelry trade in the Quaker City, and the pessimist of a month ago is the optimist of the future. Although business is not as brisk as it could be, the average number of those identified with the manufacturing end of the jewelry business are kept quite busy, and inquiries for new goods of special design are being received with an unusually good number.

Wholesale dealers, while not feeling any great demand, are highly satisfied with the amount of business being done. They are in many instances taking advantage of the quiet spell to improve their places of business, so as to be able to handle a greater volume of trade they anticipate. Retail trade is quiet, as far as the selling end is concerned, but the repair departments are witnessing a liberal amount of business.

The annual meeting of the Keystone Watch Case Company will be held in the company's office, No. 1107 Stock Exchange Building, on February 27. The stockholders of the company will be called upon to vote for or against the recommendation of the Board of Directors to sell or cover a certain portion of the company's real estate at Newark, N. J.

Albert S. Butterworth, general superintendent of the Disston Saw Company, died in the latter part of January at the Episcopal Hospital. He held positions in practically every department of the Disston Works during his career there, starting as an office boy, until he finally was raised to the position of general superintendent. He is survived by his wife and daughter. The employees of the entire Disston Works attended the funeral in a body.

Arrangements are being completed for the Pennsylvania Hardware Association Convention, which will be held in this City February 9-13.

At the annual meeting of the Board of Trade, S. P. Wetherill, Jr., president of the S. P. Wetherill Finished Castings Company; Robert E. Hastings, of Hastings & Company, gold leaf manufacturers, and Alba B. Johnson, president of the Baldwin Locomotive Works, were elected members of the executive committee. The plan of Alba B. Johnson to consolidate the three leading commercial trade organizations of the city was taken up by Mr. Wetherill, but he was ruled out of order.

Considerable interest has been expressed among the members of the local metal trade over the incorporation of the H. B. B. Motion Picture Company of this city. The object of the new concern is to take pictures of the processes necessary in the carrying on of the different industries, thus giving the generall public a conception of the number and kinds of machinery used and the amount of capital invested and the number of persons employed in the many industries. In this way it is hoped that much of the antagonistic feeling maintained by the public against what is termed "Big Business" may be successfully done away with or explained. The incorporators announced that the metal industries will be featured.—P. N. S.

WASHINGTON, D. C.

February 2, 1914.

The drawing plant of the Navy Yard here, where the brass shells are drawn from a solid piece of metal, has been working overtime in order to be prepared somewhat for war. The government works extensively in the brass line and this immense plant is always busy.

R. H. Pilson, of the Munsey building, represents the Ajax Metal Company and intends backing up some new lines in iron and steel.

William H. Douglas retired from the brass foundry bus'-

ness some time ago. The business of making brass rails and the foundry is conducted by W. P. S. Given.

William A. Knapp bought out, some time ago, the Doremus Machine Company and is making experimental models for pattern work. The Doremus plating plant was not included in the sale and it is conducted separately, in charge of Theodore Schaefer.

William White has the contract for roofing and other copper work on the House office building, which is being remodeled.

The Thomas Somerville Company, jobbers of plumbing supplies, have given up the manufacturing of brass work altogether.

W. A. Ross & Company have a very good plating plant and also make gas and electric fixtures. They will move to larger quarters and will make, in addition, brass novelties.—H. S.

January is the month of inventories, stock-taking, clearing sales, and dividends, if there be any; in short, it is the summing up of the previous year's business. February sees the decks cleared for action, ready for new business. The weather for the first month of 1914 has been all that could be desired, and as a result business in nearly all lines has been going on without a break. While there is no great rush in any particular line, most of the material men and manufacturers report that business is fairly good.

The metal industry at Washington has been fairly active during January. There are a number of very large projects now in process of completion, ready for bids, and the manufacturers and material men alike are anxiously waiting for the plans. Several very high office buildings are now going up, and within a few weeks will be ready for the inside work. The metal men here expect a busy period as soon as these buildings are turned over for the interior finishings.

A survey of the metal field shows that while there is room for improvement, both the manufacturers and material men look forward to a very good year. Certainly there is a lot of building already going on, and with what is projected, 1914 will be recorded, according to those interviewed, as an usually brisk year. Washington is fast expanding, and every year finds additions to both its residential and business sections. The building operations in every section indicate a healthy, steady growth, and the industries—metal and others—of course come in for their share of business as a result.

It was announced on January 30 that the American Smelting and Refining Company, after months of quiet investigation by the Department of Jutsice, faces prospective suit to dissolve it as a combination in restraint of trade under the anti-trust laws. Sufficient grounds for action are regarded as established. The suit will not be filed immediately, it is said. It is understood, however, that the preparations have gone so far that a bill in equity is being drawn up by the attorneys of the Department of Justice.

Suit against the smelting "trust" is regarded in Washington as of great importance, ranking next to the Standard Oil and the Steel Corporation suits. This view obtains not only because the American Smelting and Refining and the American Smelter's Securities Company, which it controls, have a combined authorized capital of nearly $150,000,000, but because of the varied activities of the two concerns. The parent company has a perpetual charter under the laws of the State of New Jersey, and deals in bar gold and silver, pig lead, copper and blue vitrol. It owns about twelve smelters and two refineries. In the corporation manual for 1913 its smelting capacity is given as 5,500,000 tons per annum and its refining capacity at 400,000 tons.—J. J. M.

LOUISVILLE, KENTUCKY

February 2, 1914.

With such repairs to distillery equipment as were required out of the way, the coppersmiths of Louisville have about reached the lowest point of the season, while other branches of the metal trades are correspondingly dull. As heretofore reported, many of the distilleries which usually have a complete overhauling before starting work omitted this at the beginning of the present season, on account of the general belief that a short crop would be manufactured, and while this indicates that there will be plenty of work for the coppersmiths during the summer, it has made things rather slack of late.

Generally speaking, however, the prospects are regarded as being for good business in most lines, general prosperity in this section and the further South being looked for. There seems to be plenty of money in the hands of the farmers and merchants, and considerable building activity, with the stimulation to the metal industry generally resulting, is expected in the spring.

Arch Wunderlich, for several years purchasing agent for the Louisville plant of the Standard Sanitary Manufacturing Company, recently resigned and took a position with E. D. Morton & Company, a local machinery and mill supply house. He has been succeeded by J. Fenner, who has been with the Louisville plant for ten years.

W. P. Davis, a well-known dealer in metals, has been out of the city recently on business, visiting several points in adjacent states on selling trips.

Business has been holding up fairly well with Matt Corcoran & Company, coppersmiths and distillery supply manufacturers, a large job being handled by them in Ontario keeping a crew busy. Little new work is in sight, however. The company has been able to keep its force busy without laying off a man for the past year, and Mr. Corcoran believes that 1914 will show an equally good record.

Under date of January 20, it was stated that the construction of the preliminary plant of the Aluminum Company of America was about completed, and operation would have started were power available. Bad weather delayed work on the power line from Ocoee River, but the management believes this line will be finished within 40 days. One of the two gigantic smelters is finished. About 900 men, in three eight-hour shifts, will be employed at beginning, and this number will be increased later. After work has begun there will be no cessation, the process of manufacture of aluminum requiring constant operation. The building and machinery alone represent an outlay of about $1,000,000. Ten carloads of bauxite will be handled each day. This is the ore from which aluminum is manufactured. All of this will go first to St. Louis, where it will be chemically treated. The Aluminum Company of America is building its own waterworks and sewers, and will have its own light and power plant, so that it will be independent of outside industries.

Hines & Ritchey recently completed the installation of a 150-bushel whiskey plant at the old Hunter distillery, Richmond, Va., the job taking six weeks. Shortly after the completion of the plant a prohibition wave made its appearance in Virginia, making prospects for the whiskey business look rather gloomy, and it now seems that there will be little more work in that part of the country for the coppersmiths.—G. D. C., Jr.

COLUMBUS, OHIO

February 2, 1914.

The metal market in Columbus and all parts of central Ohio is stronger generally. Advances all along the line have been recorded during the past month and the demand is becoming brisker. Apparently the business depression of the latter part of 1913 is passing away and the prospects for the future, especially in many lines, are much brighter.

In the automobile industry there is increasing activity, as there are signs for a better season than were apparent a month ago. Then plumbing concerns are also pretty active, and the tone of the market is satisfactory.

One of the strongest points in the local market is tin, which has advanced from 2 to 2½ cents per pound recently. Copper is also stronger, and the volume of business is larger. Lake copper is quoted at about 15¼ cents to the trade, while casting copper is strong around 14½ cents. Brass is also strong and red scraps are quoted at 10 to 10½ cents, and yellow at 8½ cents. Aluminum is still weak and apparently does not share in the strength of the other metals. Babbitt is also in good demand, and prices are steady.

Generally speaking there is a good prospect for an active demand for all metals with the possible exception of aluminum for the coming six months at least. A number of new metal-

using concerns are being organized, while those in existence are gradually increasing their output.

The E. C. Boorn Company, of Warren, Ohio, has been incorporated with a capital stock of $10,000 to do a roofing and sheet metal business. The incorporators are Inez Woodward, F. R. Woodward, Clara J. Boorn, E. C. Boorn and Ada Clark.

The Union Brass & Supply Company, of Toledo, Ohio, has been incorporated with a capital stock of $25,000 to manufacture and deal in mechanical specialties. The incorporators are H. S. Blynt, M. V. Mauk, M. R. Munn, A. J. Gisel and H. W. McClellan. The Federal Metal Company, of Cleveland, Ohio, has filed papers with the Secretary of State increasing its capital stock from $30,000 to $50,000. The American Stamping & Enameling Company formed last summer when plants worth more than $1,000,000 were consolidated, has announced that it will erect a stamping mill on a 65 acre tract at Massilon, where it owns a steel mill. After the metal is stamped it will be shipped to Bellaire to be enameled. L. E. Topper, president of the Capital City Iron & Metal Company, 454 Dennison avenue, Columbus, Ohio, filed a petition in bankruptcy for the company in the United States court here. The debts of the company amount to $20,314.24, of which the National Bank of Commerce holds a note for $3,500 and Topper Brothers one for $6,000. The assets are $15,777.25. In this amount is included $2,700 worth of wagons, machinery and fixtures attached to the junk establishment.—J. W. L.

DETROIT, MICH.

February 2, 1914.

The last month has been quiet throughout the brass and aluminum industry in this city. This condition was forecasted in the report of last month, no change being expected for several weeks to come. Every brass factory in the city reports conditions slow and many are doing but little work, a few, however, being entirely shut down. But manufacturers, however, are not in fear of any dire calamity. While many are disturbed, the majority seem to take conditions as matter of course and realize that improvement will come later in the season.

R. Raffus, president of the Detroit Art Metal Company, manufacturers of gas and electric chandeliers, states that while conditions are quiet at this time, the outlook for the future, not only in Michigan, but in other parts of the country, is good. The tendency now is simply to go slowly until the season is farther advanced.

A. W. Fussey, of the Detroit Brass Company Works, believed also that conditions will improve later in the season and factories that operate moderately now will experience a decided run of business. Politics seem to have but little, if anything, to do with the present quiet times, as manufacturers know about what the present governmental policy will be, and the quiet now is attributed to nothing more serious than the usual winter slump, added, of course, to the timidity of several months ago, when the trade was unable to forecast future business conditions.

Growth of business necessitates additional quarters for the Acme Stamping Company, now at 64 to 68 West Congress street, due to increase of business. The company manufactures brass and steel embossing dies and has built up a profitable business. The company is planning additional space to its present quarters to enable it to expand its facilities.

The Detroit Ship Building Company, a corporation that uses vast quantities of brass and aluminum and maintains a large plant for working in these metals, has under construction six large boats at the Wyandotte, Mich., yards, a suburb of Detroit. Three are car ferries, two freighters and one a passenger boat. Many other contracts are in prospect, due to the heavy loss on the great lakes during the storms of early winter.

The automobile show held last week closed with one of the finest records in the history of this line of trade. The sales were larger than last year and manufacturers are now planning for an early resumption of business. Henry Ford, who has adopted the profit sharing system for employees, is daily taking on new men and the plant has a force close to 15,000 men. Several hundred of these are employed in the brass and aluminum department. Business in all the automobile factories shows an awakening.

The strike in the copper region is not felt to any extent here, except in the way of discussion. No one knows the outcome, but it is thought the difficulties soon will be over. Gov. Ferris has the situation well in hand, and it is reported that 80 per cent. of the men are back in the mines. The greatest difficulty now is with the agitators, who are losing ground and realize that defeat is near.—F. J. H.

TORONTO, ONT., CANADA

February 2, 1914.

Many lines are on the increase here, such as high grade jewelry and silver goods. There is no factory for the making of general line of gold plated and there seems to be a good chance for this. This is a good market for silver plate of all kinds and the factories are enlarging. Another line that is extending is the oxy-acetylene welding. The metal lines are pretty well taken care of and are doing well. The aluminum business is a growing one.

The tariff in the United States has helped Canada a lot. The big business in all lines has been built up by aggressive American firms and dollars. Many American factories have branches here and more are to be built. During each year of 1912 and 1913, 88 American factories migrated here, owing to the duty, as it is the only way they can supply the large and growing Canadian trade. These 88 factories have a combined capital of $18,000,000, employing 10,875 hands, feeding 50,000 persons, with annual wages of six million dollars.

The production of silver at Cobalt was larger in 1913 than in 1912, but silver dropped a cent an ounce. There were about 30,600,000 ounces produced at Cobalt in 1913. The profit has been 50 per cent., though the cost per ounce is slowly rising as the percentage of high-grade ore diminishes and low-grade ore increases. If silver drops lower or stays where it is, it is not thought that the output this year will be over 25,000,000 ounces, but if it goes up then the amount will probably reach 29,000,000 ounces. This output depends somewhat on the conditions in China and India, where silver is the standard. Cobalt Lake will be drained and this may somewhat affect the output, otherwise the production of silver at Cobalt will be less each year, as much of the best ore has been taken out.

The nickel camp at Sudbury Mines that have been idle for years are now being worked. The Canadian Copper Company have doubled the capacity of their furnaces and the Mound Nickel Company have completed a smelter. The Anglo-American Nickel Company from the States have invaded the field and may refine here, although the others refine in the States. It is claimed there are $1.20 in each ton mined, of the precious metals alone, which helps out the nickel problem, and that the Hybinette process, an American patent, accomplishes this. There is thus a profit even if the nickel ores are of low grade.

The United Brass & Lead Company have a big plant making plumbing supplies, working in brass and also do nickel plating.

Leon Barash has for thirty years conducted the Toronto Gold and Silver Stamping Company, using gold and silver foil.

The total mineral production for the past year in British Columbia was slightly under $30,000,000. There was a falling off in coal and copper and an increase in gold, silver and lead.

The Monarch Brass Company, of 278 Dundas street, this city, will erect a new brass foundry; James Sherlock general manager.

Ernest U. Paunell, of the Toronto office of the British Aluminum Company, goes on a two months' trip to New York City, Boston, Schenectady, Cleveland and Detroit.

The Birmingham Brass Company, 14 Markham street, brass founders and working in brass, bronze and aluminum, say their business for 1913 was 25 per cent. ahead of the year before, with good prospects ahead. They have put in a polishing plant and expect to increase the staff in all departments.

The Carter Welding Company, at 9 Sheppard street, are one of the old concerns specializing in oxy-acetylene of all kinds. They can cut up to eighteen inches of solid steel and weld aluminum, brass, bronze and copper.

The old established sheet metal workers, the Pedlar People,

have moved their Toronto branch at 113 Bay street to College and Markham streets, having much larger facilities. The head office is at Oshawa, Ont.

The Malcolm & Company brass foundry has been taken over by David Dixon, who will push the business along the old lines, making plumbers' supplies mainly.

George H. Smith has opened an office at 39 Adelaide street, west, representing James Gartland & Son, of Birmingham, England, manufacturers of brass goods.

The Computing Scale Company have put in a nickel plating plant and are now in a position to do all of their own finishing.—H. S.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Wellsville Electric Plating Works, Wellsville, N. Y., are planning to install a brass foundry some time during the spring.

The Indiana Die Casting Company, 311 McGill street, Indianapolis, Ind., will double its capacity by establishing an additional plant.

The Aluminum Castings Company, Cleveland, Ohio, announce that they have discontinued their foundries at Syracuse, N. Y., New Kensington, Pa., and their plant at 772 Bellevue avenue, Detroit, Mich.

The Whiting Foundry Equipment Company, Harvey, Ill., report that they have arranged with S. R. Vanderbeck, 217 Walnut street, Philadelphia, Pa., to handle their complete line of foundry plants in the Philadelphia territory.

The Bureau of Standards, Washington, D. C., is prepared to issue a sheet brass of the following composition, approximately: Sn, 1; Pb, 1; Cu, 70.3; Zn, 27; Fe 0.3; Ni, 0.5. The fee, payable in advance, is $3 per sample of about 150 grams weight.

The National Automatic Machine Company, Battleboro, Vt., are installing a nickel and silver-plating plant. This company states that their plant is strictly up to date, and that they use the plating plant in connection with their own work as well as doing outside work.

The Cleveland Electro Metals Company, Cleveland, Ohio, have just completed alterations and enlargements to their plant which they state will triple their capacity. This company manufactures pure aluminum, standard aluminum alloys for the foundry, and special alloys to order.

The Waterbury Clock Company, Waterbury, Conn., will utilize the new building now under construction at the case factory mainly for storage purposes, which will permit the transfer to manufacturing purposes the room vacated by the stock at the present case factory. The new building will be 50 x 182 feet and five stories high.

The United Metal Manufacturing Company, Inc., Norwich, Conn., have begun work at its new plant in the building on Shipping street, which was formerly occupied by the Sterling Machine Company. The construction work on the new brass foundry which the company is erecting is under way and it is thought that it can be in operation inside of a month.

The new plant of the Perfection Oil Stove Company, located at Sarnia, Ontario, Canada, is being rushed towards completion. The steel work for the building was fabricated at Cleveland, Ohio, and shipped ready to be erected. Practically all of the equipment for the Sarnia plant, which will be of the punch press line, will be shipped from Cleveland.

The Roessler & Hasslacher Chemical Company, New York, on January 14 made a demonstration of Trisalyt before the Rochester branch of the American Electro-Platers' Society at the University of Rochester. A demonstration of the use of Trisalyt in copper, silver, gold and brass solutions was made and technical questions were answered by members of the firm.

The Wheeling Metal and Manufacturing Company, Wheeling, W. Va., are contemplating the erection of an addition to their plant at Glendale, W. Va., some time during 1914. The building, when completed, will be occupied as a press room in connection with the manufacture of galvanized shingles. The company is also planning to erect a new office building this coming spring, as their present quarters are too small to conveniently carry on all their business.

The Waterbury Brass Goods Corporation, Waterbury, Conn., announce the election of the following officers: President, John A. Coe, Jr.; treasurer, Gordon W. Burnham, New York; assistant treasurer, James L. Smith; secretary, John P. Durfee; directors, Charles F. Brooker, of Ansonia, Conn., Gordon W. Burnham of New York, John A. Coe, Jr., John P. Durfee, John P. Elton, Edward L. Frisbie, Gilman C. Hill, Thomas B. Kent of New York and James L. Smith.

The General Smelting Company are equipping their works at Montpelier, Clarksburg, W. Va., for the handling of aluminum and high-grade metals, both from the ore and from the crude metals, as well as special chemicals and expert work of various kinds. This company has recently made an exhaustive report involving a great deal of research work on the liquid output of the Carter, Sheets & Jarvis big gas well near Salem, W. Va., showing by original methods of extraction the various minerals.

The Charlotte Plating & Brass Company, Charlotte, N. C., have filed a certificate of amendment reducing the amount of capital stock with which the company will commence business with from $15,000 to $4,000, subscribed by W. C. Murphy, P. E. Thomason and R. L. Rutzler. This company states that they now have a brass foundry in operation and can furnish castings in copper, brass, bronze and aluminum, and that they are equipping their plant with machinery and also electro-plating outfit, and in the course of a few weeks will be able to furnish finished castings. They are in a position to fill orders to specifications or of their own standard mixtures.

The Ideal Furnace Company, Chester, Pa., state that the Chicago Bearing Metal Company, Chicago, Ill., are discontinuing the use of their oil furnaces and have recently installed twelve No. 1 "Ideal" coke fired tilting crucible furnaces. The Tottenville Copper Works, Tottenville, N. Y., are also installing the Ideal furnaces after a competitive test with another make of coke furnace. Orders booked by this company during the month of January include furnaces for the Ingersoll-Rand Company, Phillipsburg, N. J.; Doehler Die Casting Company, Brooklyn, N. Y.; Hodgson Foundry, Chicago, Ill.; the Pullman Company, Pullman, Ill.; Ellison & Richter, Jamestown, N. Y., and the Century Foundry Company, Syracuse, N. Y. This company reports business as being brisk, and are considering moving to a larger plant where they intend to go into the manufacture of core ovens and annealing furnaces of an improved type.

BRASS COMPANY'S SALESMEN MEETING

The annual convention of the salesmen and school of instruction which is held every year by the H. Mueller Manufacturing Company, at Decatur, Ill., was held the week of January 4, 1914. The school opened on December 29, 1913, and continued for the entire week, with night sessions, until January 4, when it wound up with a huge annual meeting and banquet of the Forty-nine Club, composed of the salesmen and officers of the firm. During the sessions of the school different subjects are discussed and goods demonstrated, and each salesman is permitted to express his opinion on all questions that may arise. Subjects connected with the selling of brass goods are gone

over as, for instance, how the goods can be disposing improved, new markets developed and the best ways and means of disposing of the products. A description of the new branch plant of this enterprising plant at Sarnia, Ontario, Canada, was published in THE METAL INDUSTRY for October, 1913.

FIRES

The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., state that the building recently destroyed by fire was outside of their plant and about two blocks from their brass foundry and was used by them for the storage of patterns used for their own work exclusively.

The National Aluminum Works, Wellsville, N. Y., occupying an entire city block and probably the largest independent aluminum factory in the world, was totally destroyed by fire January 19. The loss is probably about $250,000. It is thought the blaze started in the new annex, where the benzine tank might have exploded. There were 100 employes in the building at the time, all of whom had to fly for their lives. The entire structure was reduced to a mass of ruins in one hour. There were no fatalities, but some narrow escapes. At one time several other buildings caught fire and the entire city was in danger, but the flames were gotten under control. Nothing was saved for the company, which was a local company, organized seven years ago by John E. Potter, the general manager. Over 200 people find employment at the works, which was one of the largest factories in Wellsville. The company had recently imported from England thousands of dollars' worth of valuable raw aluminum sheet metal, which, while it will not be destroyed, was reduced to a molten mass and will have to be shipped to a rolling mill and rolled into sheets before it can be used. It has been the intention to soon install a sprinkler system. Insurance to the amount of $73,000 was carried on the building and machinery. While nothing definite has been decided on, it is thought that the company will, without much delay, rebuild the factory larger than before and of steel and cement or brick construction.—H. S.

REMOVALS

A. Schrader's Sons, Inc., 28-32 Rose street, New York, announce that they have removed their factory and offices to 783-791 Atlantic avenue, Brooklyn, N. Y.

The Standard Machinery Company, Providence, R. I., have moved their plant from that city to their new building at Auburn, R. I. They started operating in their new quarters on February 2.

INCREASE IN CAPITAL STOCK

The Rockwell Silver Company, Meriden, Conn., has increased its capital stock from $20,000 to $30,000. This company operates a sterling silver smith room and a plating room.

FOREIGN TRADE OPPORTUNITIES

[In applying for addresses at Bureau of Foreign and Domestic Commerce, Washington, D. C., refer to file number.]

No. 12356. Arsenic.—An import and export firm in a foreign country has written an American consul that it is interested in arsenic (As_2O_3) 93 per cent., and arsenic (As). The firm believes that it can dispose of several hundred tons of both products and is anxious to secure at the earliest possible moment price c. i. f. Australian ports, codes, packing, etc., for shipment in 50-ton lots.

PRINTED MATTER

Cupola Lining.—Frederic B. Stevens, Detroit, Mich., describes the Stevens' Interlocking cupola blocks in a leaflet just issued and he claims the interlocking joint of the block locks out the fire and lengthens the life of the lining.

Gears.—The Mesta Machine Company, of Pittsburg, Pa., have issued bulletin K, which describes and illustrates their line of machine molded gears and rolling mill pinions, together with a description of their cut gears for which practically no blacklash is claimed.

Furnace Service.—The W. S. Rockwell Company, New York, have issued a catalog of Rockwell furnace service for industrial heating operations. This catalog, which consists of sixteen pages with the cover, gives a complete description and illustration of the numerous types of furnaces manufactured by this company.

Powdered Coal.—The Quigley Furnace and Foundry Company, engineers and contractors, New York, have issued bulletin No. 4, setting forth the advantages of powdered coal when used as fuel. The matter in the bulletin is made up from a paper read by W. S. Quigley at the American Foundrymen's Association at the convention at Chicago in October, 1913.

Monel Metal.—The Supplee-Biddle Hardware Company, Philadelphia, Pa., and New York, distributors of monel metal, have issued their bulletin for January, 1914. This bulletin is devoted to the uses and application of monel metal and this particular issue contains photographs of the officials of the new Supplee-Biddle Hardware Company. An account of the consolidation of this concern was given in the January number.

Pyrometers.—A very attractive calendar has been issued by the Brown Instrument Company, Philadelphia, Pa., in the interests of the line of pyrometers manufactured by this company. The calendar is printed in white on brown cardboard and is embellished with a half-tone reproduction of the firing of a twenty-inch gun at Fort Wadsworth. The company will be glad to send copies of the calendar upon request.

Galvanizing.—The Metal Treating and Equipment Company,, New York, have issued a pamphlet on the "Protection of Iron and Steel Against Corrosion" by means of the Standard galvanizing process of which this company is the originator. The book contains a comparison of the hot and cold galvanizing processes now in use and also gives a number of reasons why the Standard galvanizing process is superior to other processes that are being used throughout the country.

Fuel Oil.—The Gilbert & Barker Manufacturing Company, Springfield, Mass., have issued a twenty-eight page catalog in which they describe the Gilbert & Barker process for burning fuel oil under low pressure. After stating some interesting facts relating to oil when used in place of coke, coal or gas and the burner and the plant are illustrated and described, some tables showing some comparison with oil fuel with gas fuel are then given and the booklet concludes with a number of testimonials from users of the Gilbert & Barker Process.

Nickel Salts.—D. B. Moyer, secretary, Detroit Platers Supply Company, Detroit, Mich., announces that they are now manufacturing a rapid nickel plating salt that will maintain its gravity at 16 degrees Baumé and this solution is guaranteed to plate all metals except aluminum, zinc and lead, which must be copper plated first, and do this work in one-third the time that Dr. Adam's salts will take for the same work. A barrel of these salts will be shipped on approval to responsible parties under the above guarantee, to be accepted subject to their approval and if not satisfactory in every way may be returned. All this information is included in Bulletin No. 300, descriptive of these nickel salts and which will be mailed upon request.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

New York, February 9, 1914.

COPPER.

Consumers of copper seem to be gradually forgetting the trick that was played them by the Producers and Selling Agents late in December when the price was advanced from 14 to 15 cents—the London speculative market was used to boost the price of standard and on the strength of the London advance heavy lines of copper were sold and price was pushed up one cent a pound to 15 cents.

When the figures of the Copper Producers' Association were published on January 8 showing an increase in the stocks of over 43 million pounds, with a domestic consumption of about 22 million pounds, the copper consumers felt that they had been misled by the selling agents because an advance of one cent per pound was not justified at that time.

The domestic trade was very slow to come into the market again and it was not until towards the end of the month that buying was active. Of course, on the publication of the December figures on January 8 prices quickly dropped and from 15 cents the market sagged off to around 14¼. Europe was a buyer and prices have been pushed again to 14¾-14⅞ and home buyers have come into the market at from 14½ to 14⅞. The market today is firm again and good business is being negotiated.

The exports for the month are very heavy, 35,566 tons, and yet the European statistics, published February 2, show a decrease of over 2,000 tons in the stocks during the last half of the month.

The market is quotable today: Lake, 15 cents; electrolytic, 14¾ to 14⅞; casting brands, 14½ to 14⅝ cents.

TIN.

The tin market, after the usual ups and downs, opening at around 36¾ cents, prices have been run up to 40¾ cents, an advance of 4 cents per pound. The London market is said to be controlled by a strong bull crowd and 50-cent tin is said to be in the making again.

Consumption in America for January was 3,600 tons. The tin plate mills of the country are all busy and the prospects for good tin deliveries are very favorable.

Prices today are around 41 cents for spot to 41¼ cents for futures.

LEAD.

The market has held very steady at the trust price of 4.10 cents, New York basis; today, February 9, the Trust advanced prices $1 per ton to 5.15, New York. The market is firmer and the independents are not eager sellers of futures.

SPELTER.

The spelter market today is quiet and fairly steady at around 5.40, New York. This price is about 10 points higher than a month ago. Consumers have been buying more freely. Sheet zinc has been reduced 25 cents to 7¼ at mill.

ALUMINUM.

There has been no change in aluminum prices and market today is very quiet at 18¾ to 19 cents.

ANTIMONY.

Prices are about the same as last month, business has been very dull. Cookson's is quotable at 7¼, Hallett's 7 cents and Hungarian grade at around 6 cents.

SILVER.

Silver market has been dull and prices show little change, 57¾ cents, New York, and 26 7/16d. in London.

PLATINUM.

The platinum market has been very dull and prices are unchanged. Ordinary refined $43 to $44, with hard at $46 to $47.50.

QUICKSILVER.

The trust has kept price of wholesale lots around $38 a flask, while jobbing lots are selling at from $39 to $40 a flask.

SHEET METALS.

Sheet copper was reduced today ¼ cent per pound to 20 cents base. This reduction coming at the time of the highest price of ingot copper for the month is hardly likely to be followed by the trade at large and it is predicted the American Brass Company will withdraw their notice. Copper wire is quotable today at around 15¾ to 16 cents. High sheet brass is reduced 25 points to 14½ and seamless brass tubing reduced 50 cents, but all may be advanced before long, as tin and copper are both stronger.

OLD METAL.

There has been some good business done with Europe and prices are from 25 to 50 cents higher than a month ago.—J. J. A.

JANUARY MOVEMENTS IN METALS

Copper.	Highest.	Lowest.	Average.
Lake	15.50	14.50	14.75
Electrolytic	15.00	14.25	14.50
Casting	14.60	14.00	14.25
Tin	40.00	36.50	37.75
Lead	4.20	4.10	4.15
Spelter	5.40	5.25	5.33
Antimony (Hallett's)	7.10	7.00	7.05
Silver	58	57⅛	57.55

WATERBURY AVERAGE

The average price of Lake Copper per pound as determined monthly at Waterbury, Conn.

1912—Average for year, 16.70. 1913—Average for year, 15.83. 1914—January, 14.75.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

February 9, 1914.

		Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, January 1, 1914..		91,438,867
Production of marketable copper in the United States from all domestic and foreign sources during January, 1914		131,770,274
		223,209,141
Deliveries:		
For domestic consumption	47,956,955	
For export	87,955,501	
		135,912,456
Stocks of marketable copper of all kinds on hand at all points in the United States, February 1, 1914..		87,296,685
Stocks decreased during the month of January		4,142,182

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the Report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

INQUIRIES AND OPPORTUNITIES

Under our directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

Metal Prices, February 9, 1914

METAL PRICES.

	Price per lb. Cents.
COPPER—PIG AND INGOT AND OLD COPPER. Duty Free. Manufactured 5 per centum.	
Lake, carload lots, nominal	15.25
Electrolytic, carload lots	15.00
Castings, carload lots	14.75
TIN—Duty Free.	
Straits of Malacca, carload lots	40.00
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 25%. Pig lead, carload lots	4.15
SPELTER—Duty 15%. Sheets, 15%.	
Western, carload lots	5.40
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	23.00
100 lb. lots, f. o. b. factory	21.00
Ton lots, f. o. b. factory	19.00
ANTIMONY—Duty free.	
Cookson's cask lots, nominal	7.25
Hallett's cask lots	7.00
Hungarian grade	6.00
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad. valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity .40 to	.45
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL—Duty 10%	.90
MAGNESIUM METAL.—Duty 25% ad valorem (100 lb. lots)	1.50
BISMUTH—Duty free	2.00
CADMIUM—Duty free	.95
CHROMIUM METAL—Duty free	.98
QUICKSILVER—Duty 10%	.53
	Price per oz.
GOLD—Duty free	$20.67
PLATINUM—Duty free	43.50
SILVER—Government assay bars—Duty free	57¾

INGOT METALS.

		Price per lb. Cents.
Silicon Copper, 10%	according to quantity	27 to 32
Silicon Copper, 20%	" "	34 to 36
Silicon Copper, 30% guaranteed	"	36 to 38
Phosphor Copper, guaranteed 15%	"	21½ to 27½
Phosphor Copper, guaranteed 10%	"	23 to 27
Manganese Copper, 25%	" "	25 to 29
Phosphor Tin, guaranteed 5%	" "	61 to 63
Phosphor Tin, no guarantee	" "	45 to 48
Brass Ingot, Yellow	" "	10½ to 10⅞
Brass Ingot, Red	" "	12 to 14
Bronze Ingot	" "	14 to 15
Manganese Bronze Ingots	" "	15½ to 16
Phosphor Bronze	" "	20 to 23
Casting Aluminum Alloys	" "	16 to 18

PHOSPHORUS—Duty free.
According to quantity .... 30 to 35

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
12.75 to 13.00	Heavy Cut Copper	14.00 to 14.25
12.50 to 12.75	Copper Wire	13.50 to 13.75
11.25 to 11.50	Light Copper	12.50 to 12.75
10.50 to 10.75	Heavy Mach. Comp.	12.50 to 12.75
7.25 to 7.50	Heavy Brass	8.75 to 9.00
6.25 to 6.50	Light Brass	7.75 to 8.00
7.50 to 7.75	No. 1 Yellow Brass Turnings	8.00 to 8.50
9.50 to 10.00	No. 1 Comp. Turnings	10.75 to 11.00
3.50 to ——	Heavy Lead	—— to 3.90
3.75 to ——	Zinc Scrap	4.15 to 4.25
5.50 to 6.50	Scrap Aluminum Turnings	7.00 to 8.00
11.50 to 12.00	Scrap Aluminum, cast, alloyed	13.00 to 14.00
13.00 to 14.00	Scrap Aluminum, sheet (new)	14.00 to 15.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 23.00	Old Nickel	20.00 to 23.00

PRICES OF SHEET COPPER.

BASE PRICE, 20 Cents per Lb. Net.

SIZE OF SHEETS. Width.	LENGTH.	64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
		Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

ZINC— Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill.....7.25 basis, less 8%
Casks, jobbers' prices .... 8c.
Open casks, jobbers' prices .... 8½c.

Metal Prices, February 9, 1914

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.
In effect February 2, 1914, and until further notice.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14½	$0.16⅝	$0.17¾
Wire	.14¼	.16⅝	.17¾
Rod	.14¼	.17⅛	.18¾
Brazed tubing	.19	——	.22½
Open seam tubing	.19	——	.22½
Angles and channels, plain	.19	——	.22½

80% discount from all extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass.... ½c. per lb. net advance
" —Best spring, drawing and spinning brass.... 1½c. " " " "
Wire —Extra spring and brazing wire............. ½c. " " " "
" —Best spring and brazing wire............... 1c. " " " "

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.15¾	$0.17⅝	$0.19
Wire	.15½	.17⅝	.19
Rod	.15½	.18¾	.20
Brazed tubing	.20¼	——	.23¾
Open seam tubing	.20¼	——	.23¾
Angles and channels, plain	.20¼	——	.23¾

Net extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass.... ½c. per lb. net advance
" —Best spring, drawing and spinning brass.... 1½c. " " " "
Wire—Extra spring and brazing wire .... ½c. " " " "
" —Best spring and brazing wire .... 1c. " " " "

BARE COPPER WIRE—CARLOAD LOTS.

15¾c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order.......................... 20½c. per lb. base
100 lbs. to 300 lbs. in one order.......................... 21c. " " "
Less than 100 lbs. in one order.......................... 22½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, 19c. per lb.
Seamless Copper Tubing, 22½c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
27	26	21	20	19	19	19	19	19	19	19	20	21	23	25	26

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1⅛ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	60

Discount 50—5%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Red.. 18c. net base
Muntz or Yellow Metal Sheathing (14" x 48") .... 15c. " "
" " " Rectangular sheets other than Sheathing 17½c. " "
" " " Rod .... 15c. " "
Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 24¼c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin.—Not over 18 in. in width or thinner than No. 26 B. S. Gauge, 5c. above price of pig tin in same quantity. Prices of greater width and thinner gauges on request.

No. 1 Britannia Metal.—Not over 18 in. in width or thinner than No. 26 B. & S. Gauge, 4c. above price of pig tin in same quantity. Prices of greater width and thinner gauges on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	1 ton.	500 lbs.	50 lbs.	Less than 50 lbs.
20 and heavier	3-30	30c.	34c.	36c.	38c.
21 to 24 inclusive	3-30	32c.	35c.	37c.	39c.
	30-48	33c.	37c.	39c.	41c.
	48-60	39c.	40c.	42c.	44c.
25 and 26	3-30	33c.	36c.	38c.	40c.
	30-48	35c.	38c.	40c.	42c.
27	3-30	36c.	37c.	39c.	41c.
	30-48	39c.	40c.	42c.	44c.
28	3-30	37c.	38c.	40c.	42c.
	30-48	40c.	41c.	43c.	45c.
29	3-30	38c.	39c.	41c.	43c.
	30-48	42c.	43c.	45c.	47c.
30	3-30	39c.	40c.	42c.	44c.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. Charges made for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 24 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	19	9	8	15	23
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	..	27	26	26	22	22	20	20	20	20	26	30	36
18.	.049.	..	..	..	..	32	29	28	27	24	25	25	25	..	..	..	..	..
20.	.035.	116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	60
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..
24.	.022.	187	132	107	87	78	72	61	59	65	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb....	33	33½	33½	34	34½	35	35½	36	37	38	39	44	47

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4 per cent. to No. 19, B. & S. Gauge, inclusive.......................... $0.60
6 " " 19, " " " .... .70
9 " " 19, " " " .... .85
12 " " 19, " " " 1.00
15 " " 19, " " " 1.15
16 " " 19, " " " 1.20
18 " " 19, " " " 1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2¼c. to 3¼c. above the price of bullion.